Cosmochemistry of the Early Solar Nebula

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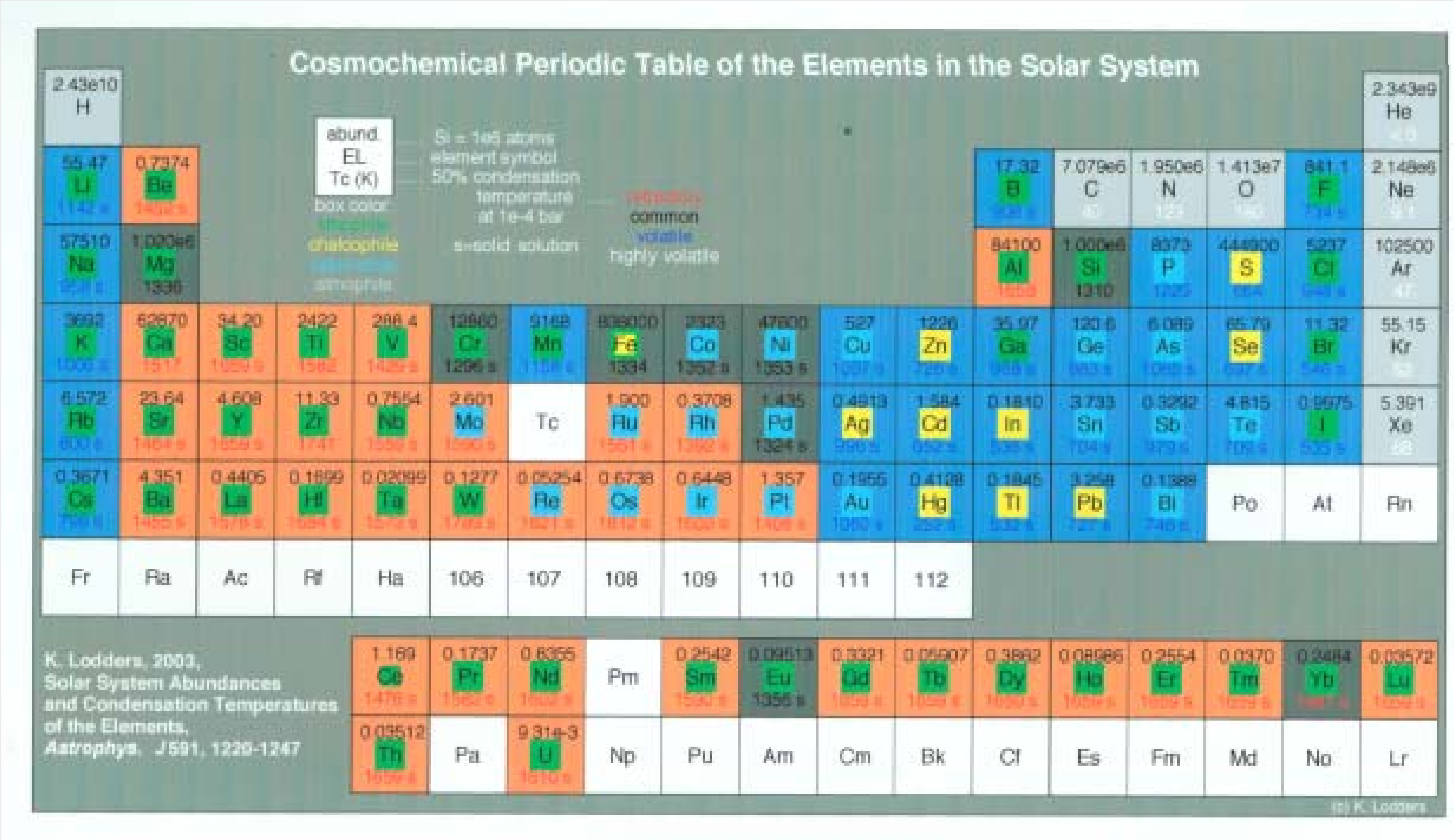
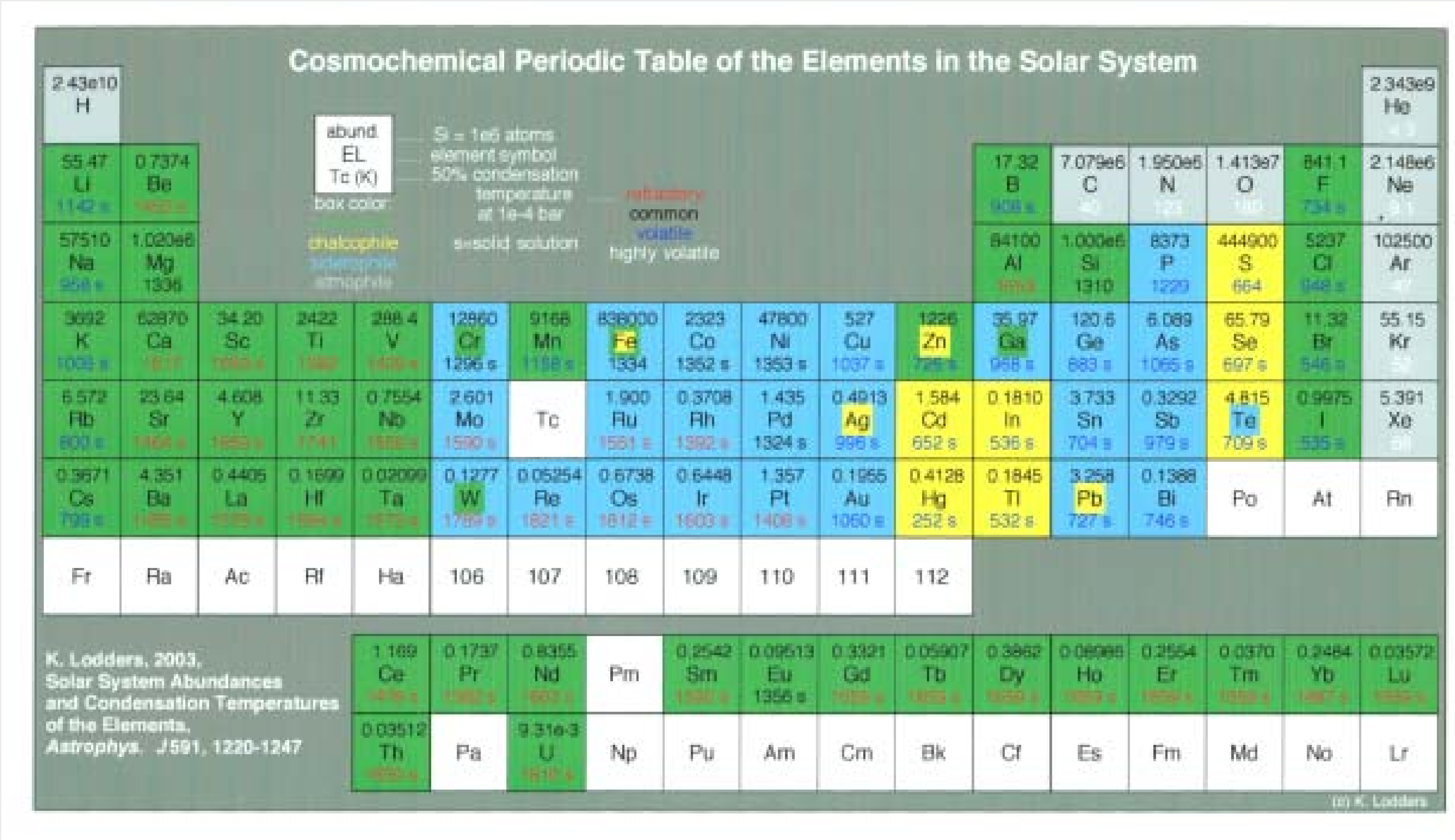
Harold Clayton Urey 1893-1981



Refractory

Intermediate

Volatile

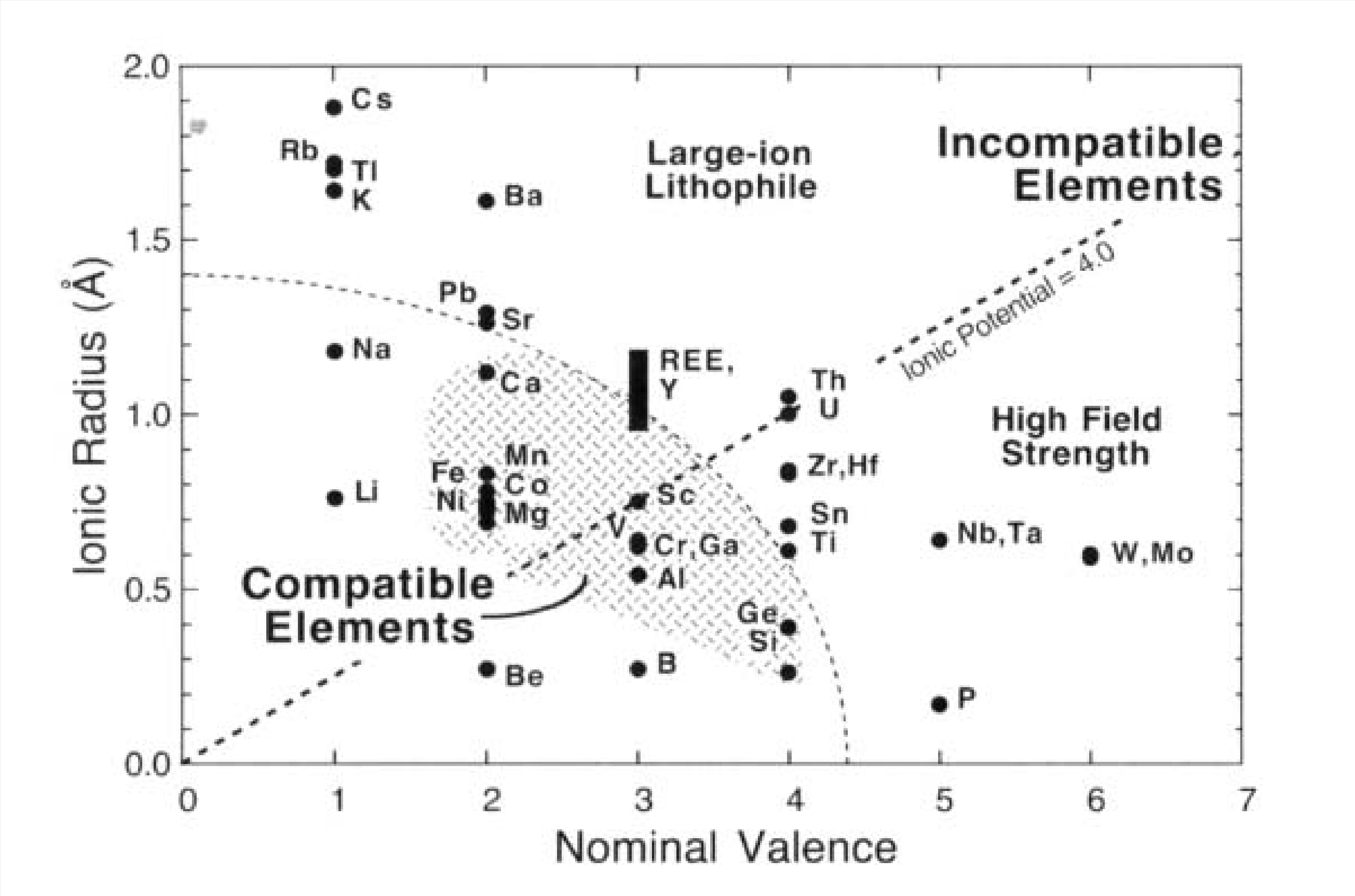


Lithophile

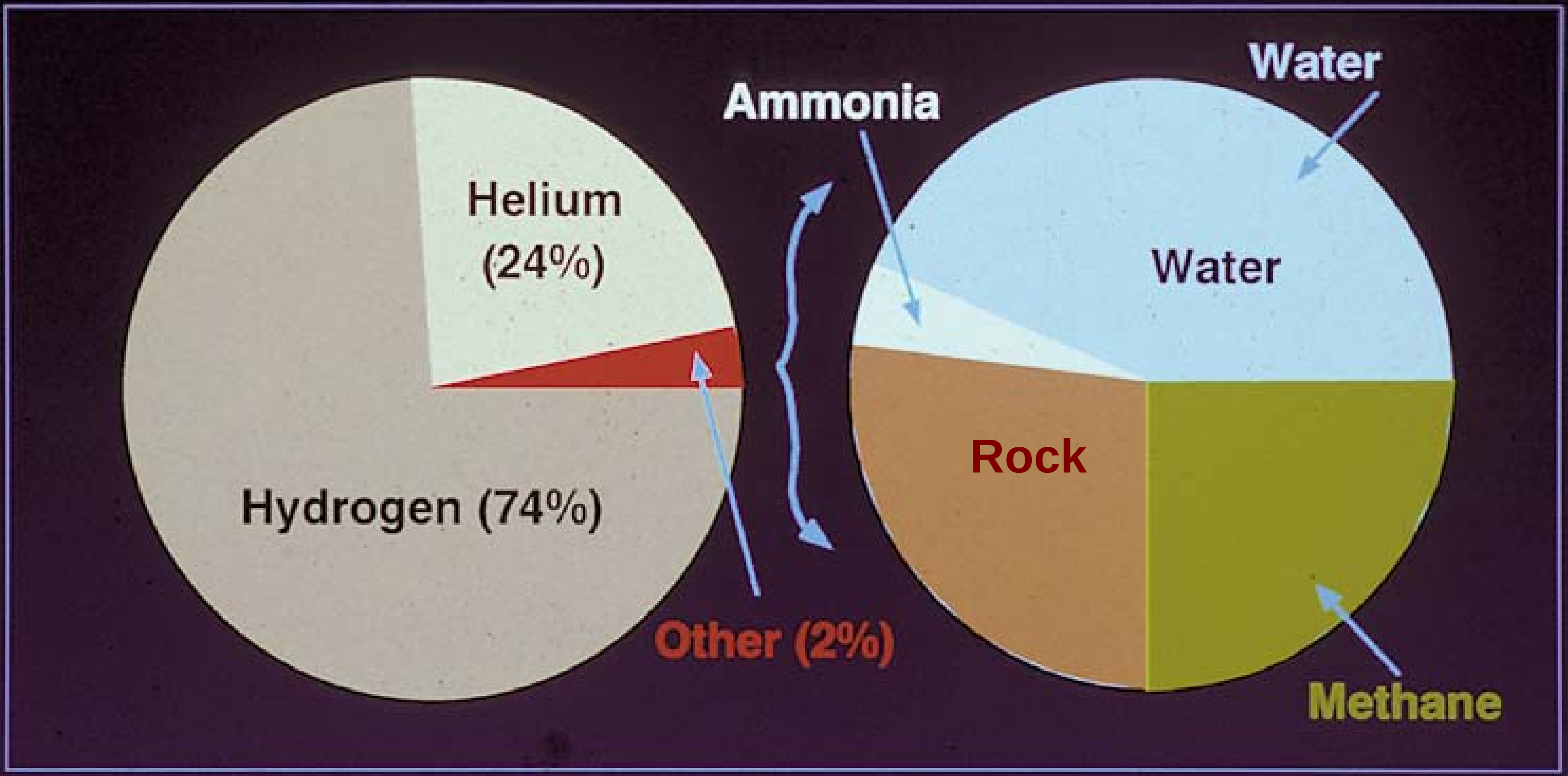
Siderophile

Chalcophile

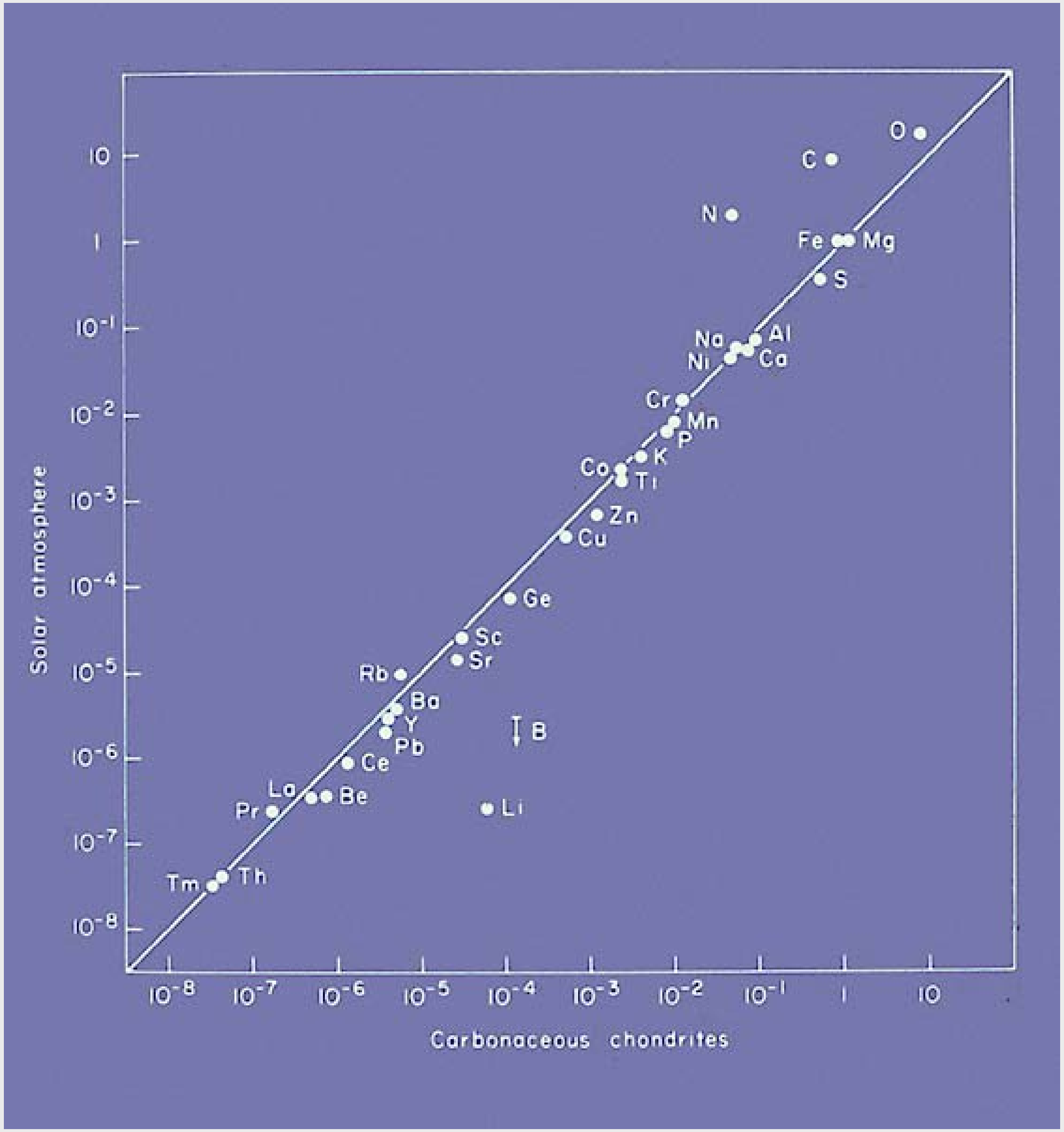
Lithophile element distribution in silicates

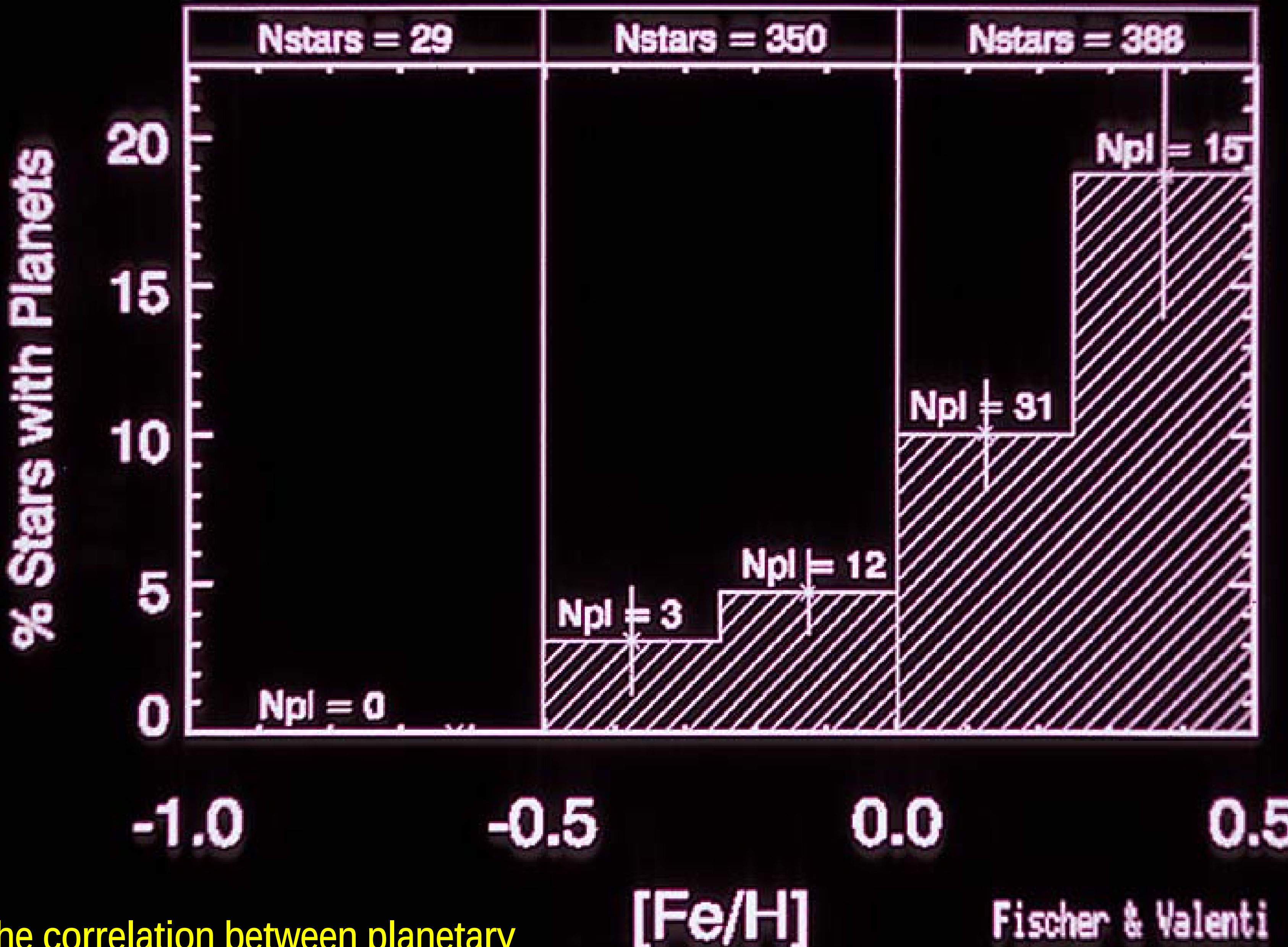


Gas, ice and rock fractions in primordial nebula



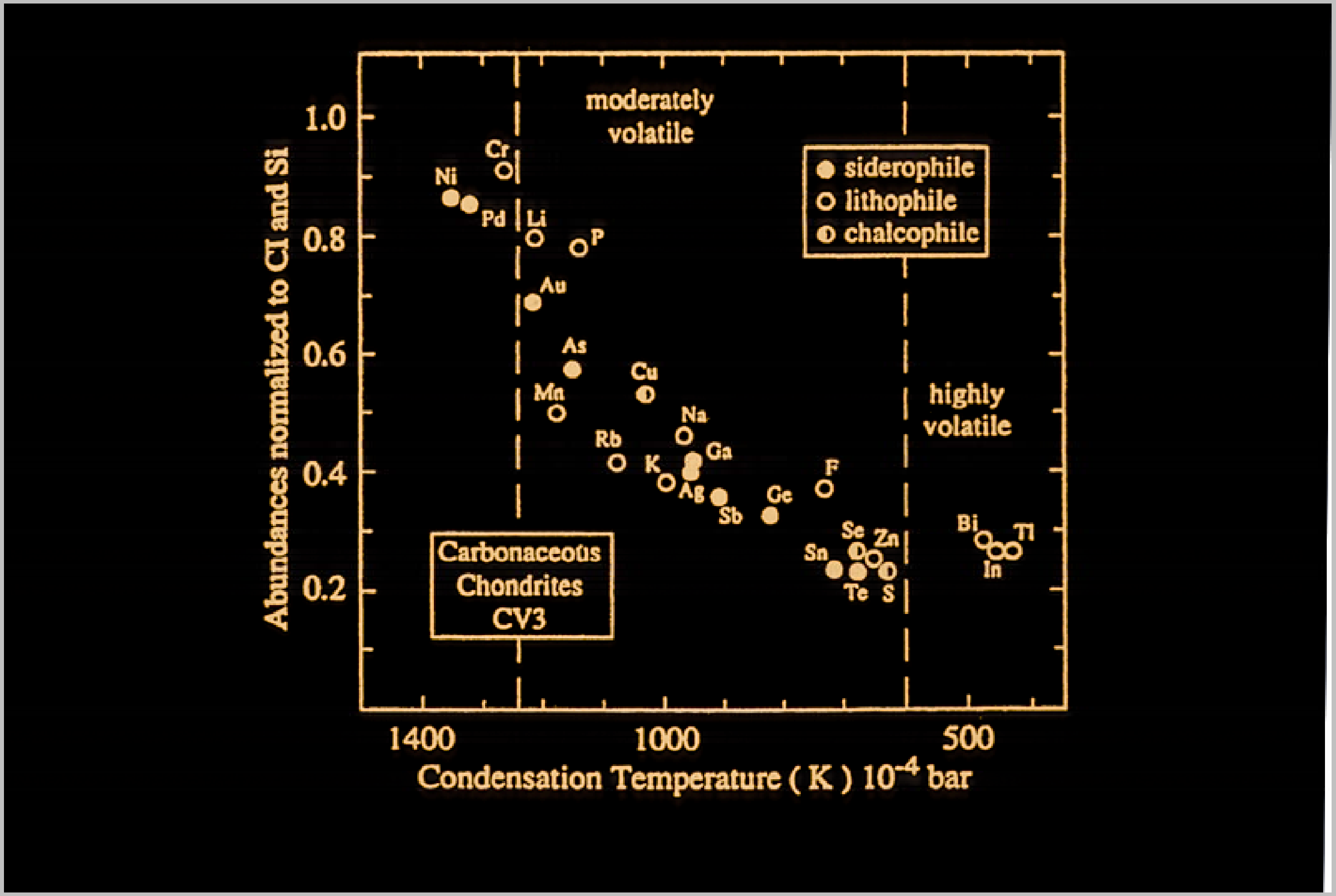
Elemental abundances, relative to Si, in the solar photosphere and in CI meteorites



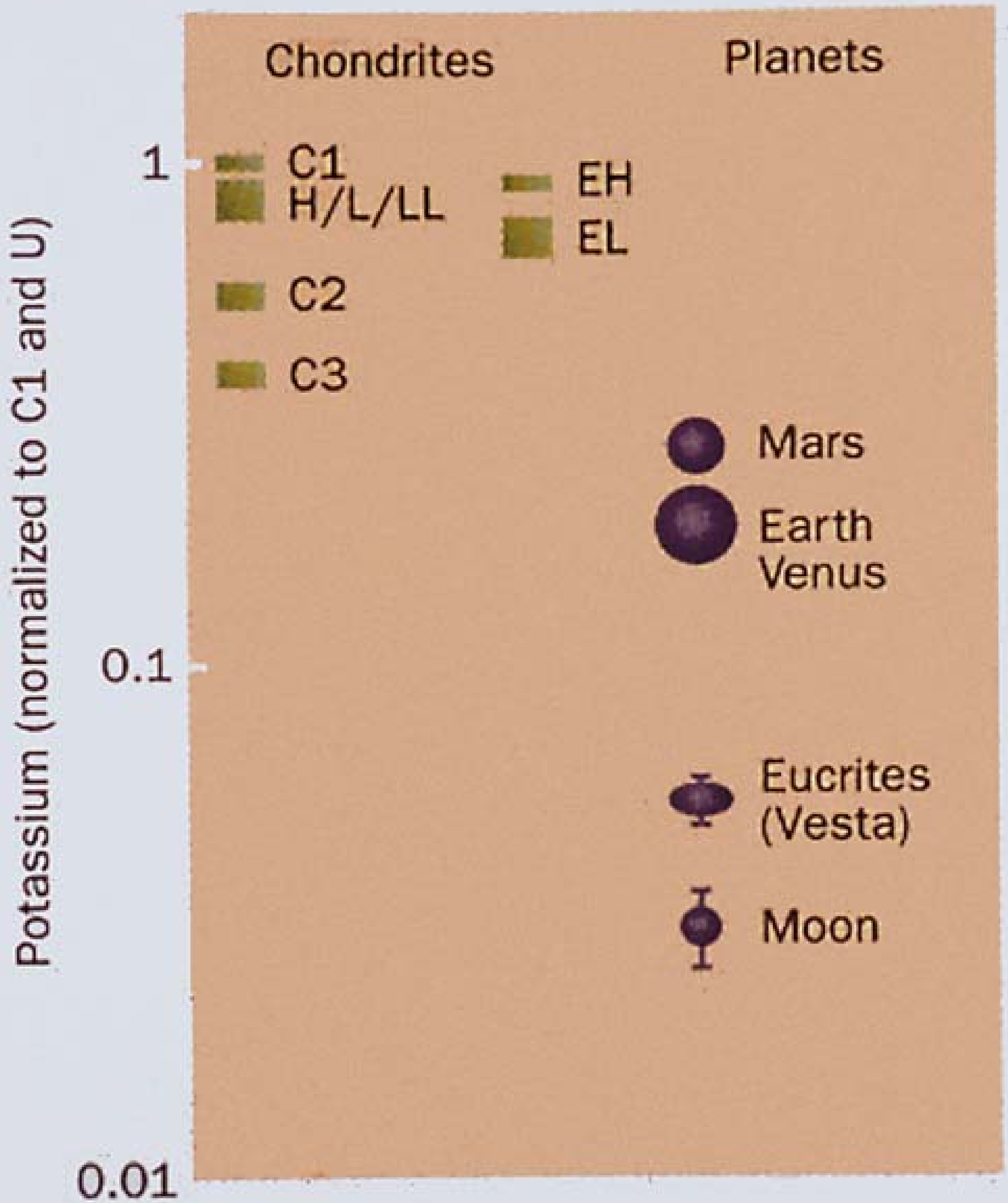


The correlation between planetary abundances and metal rich stars

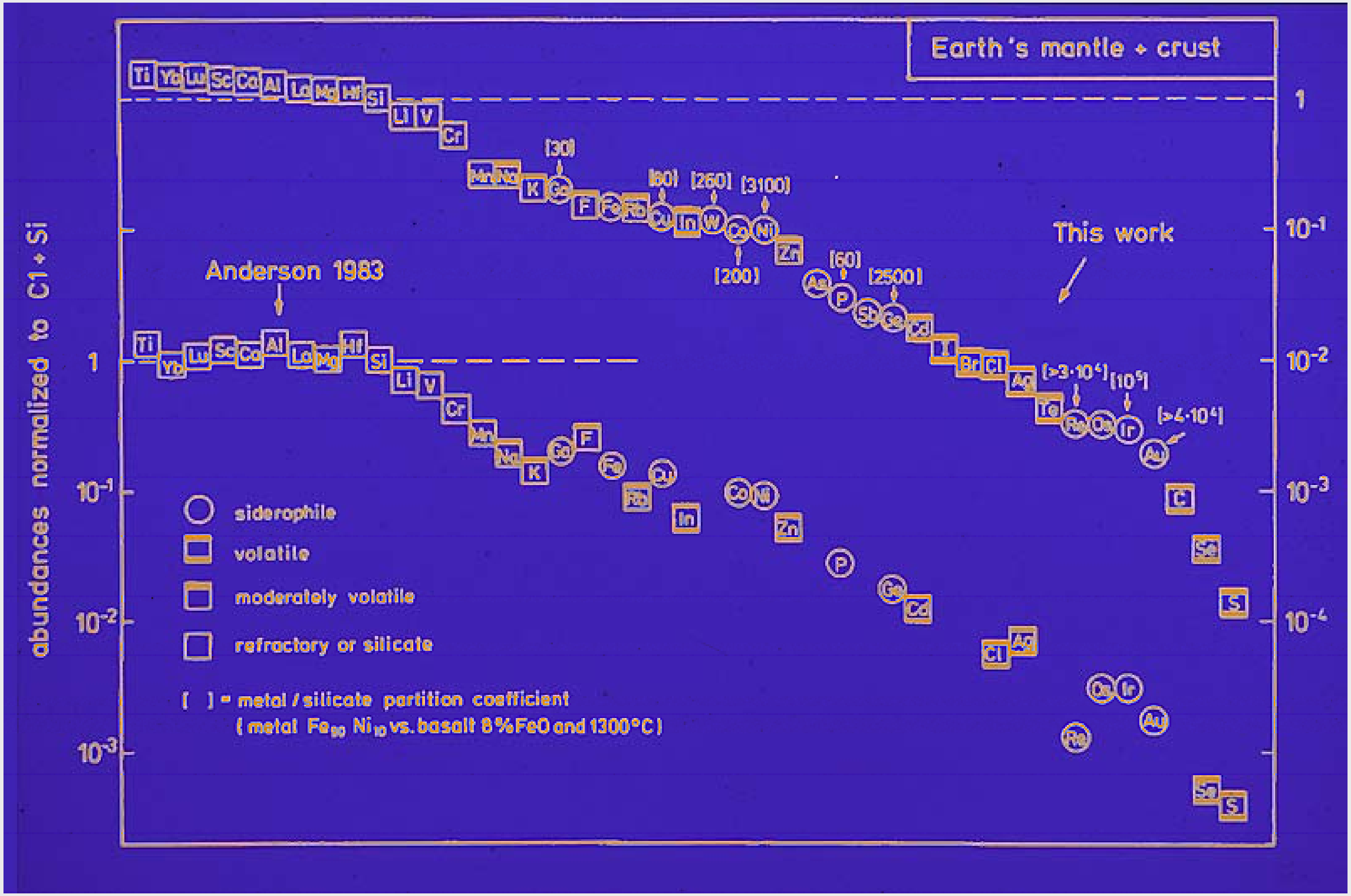
Element depletion in CV3 meteorites, relative to CI, correlates with volatility (Palme)



Depletion of volatile potassium relative to refractory uranium In the inner solar system (Humayun)

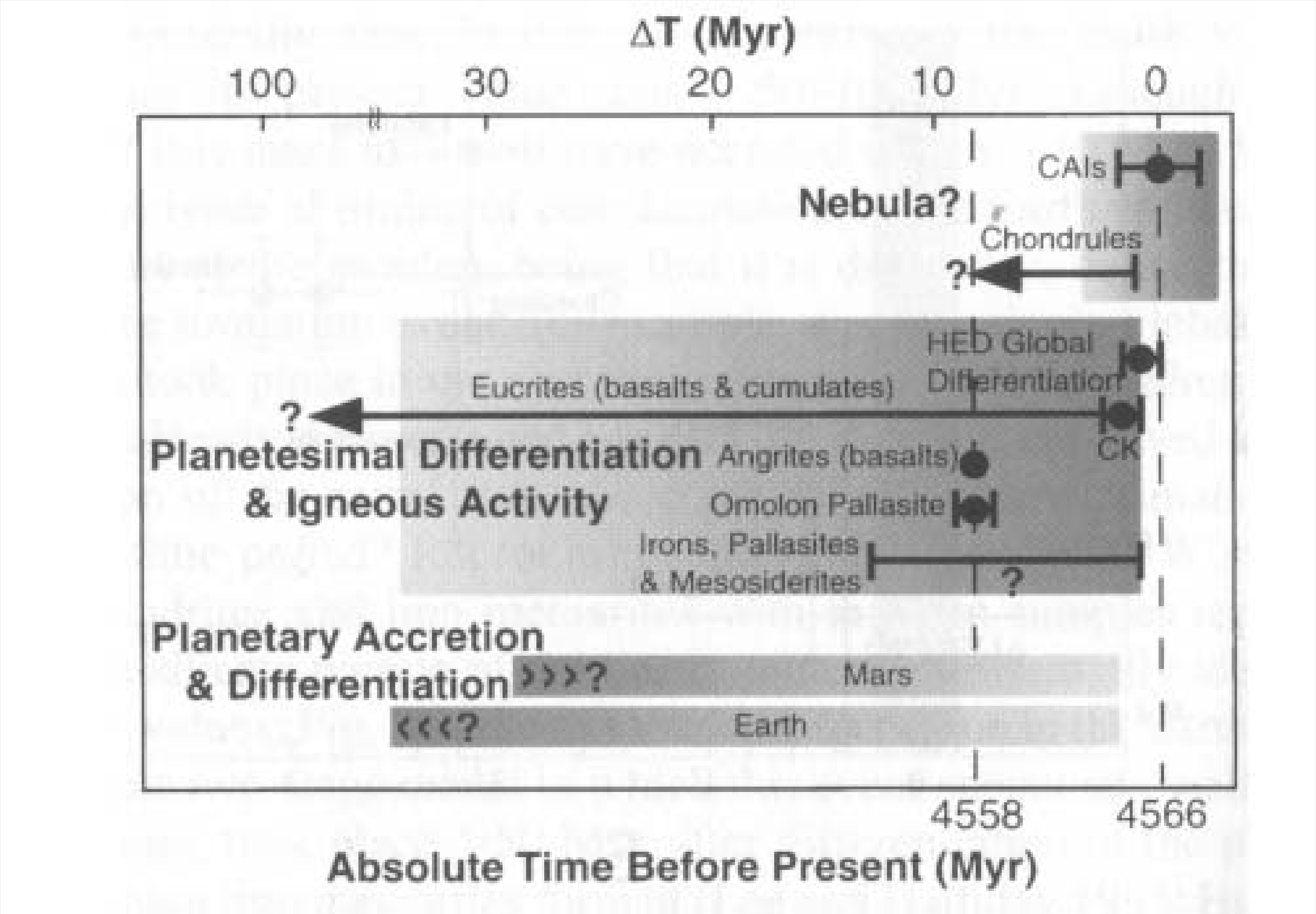


Elemental depletions, relative to CI, in the Earth correlate with volatility (Wänke)

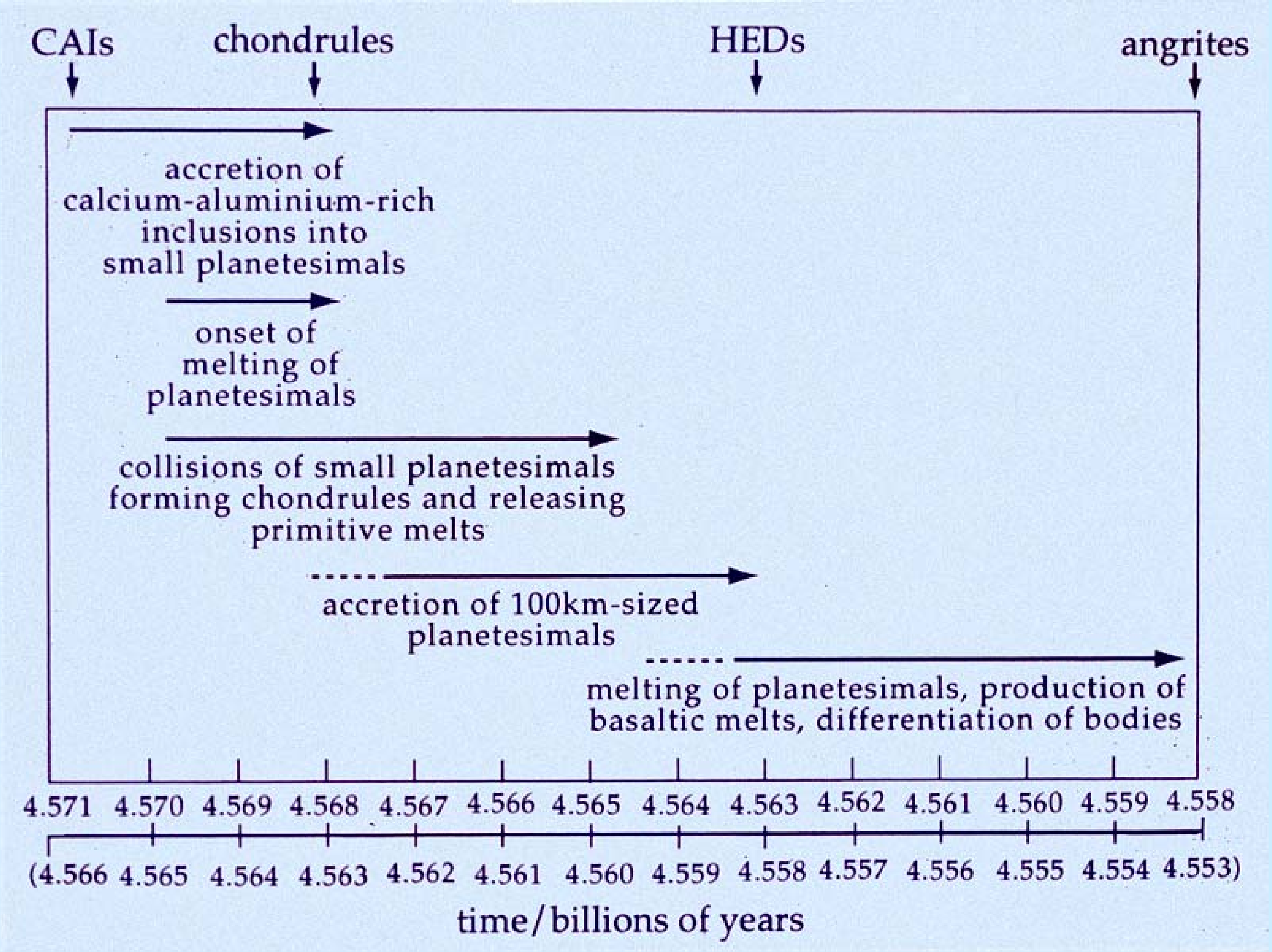


Early nebular timescales

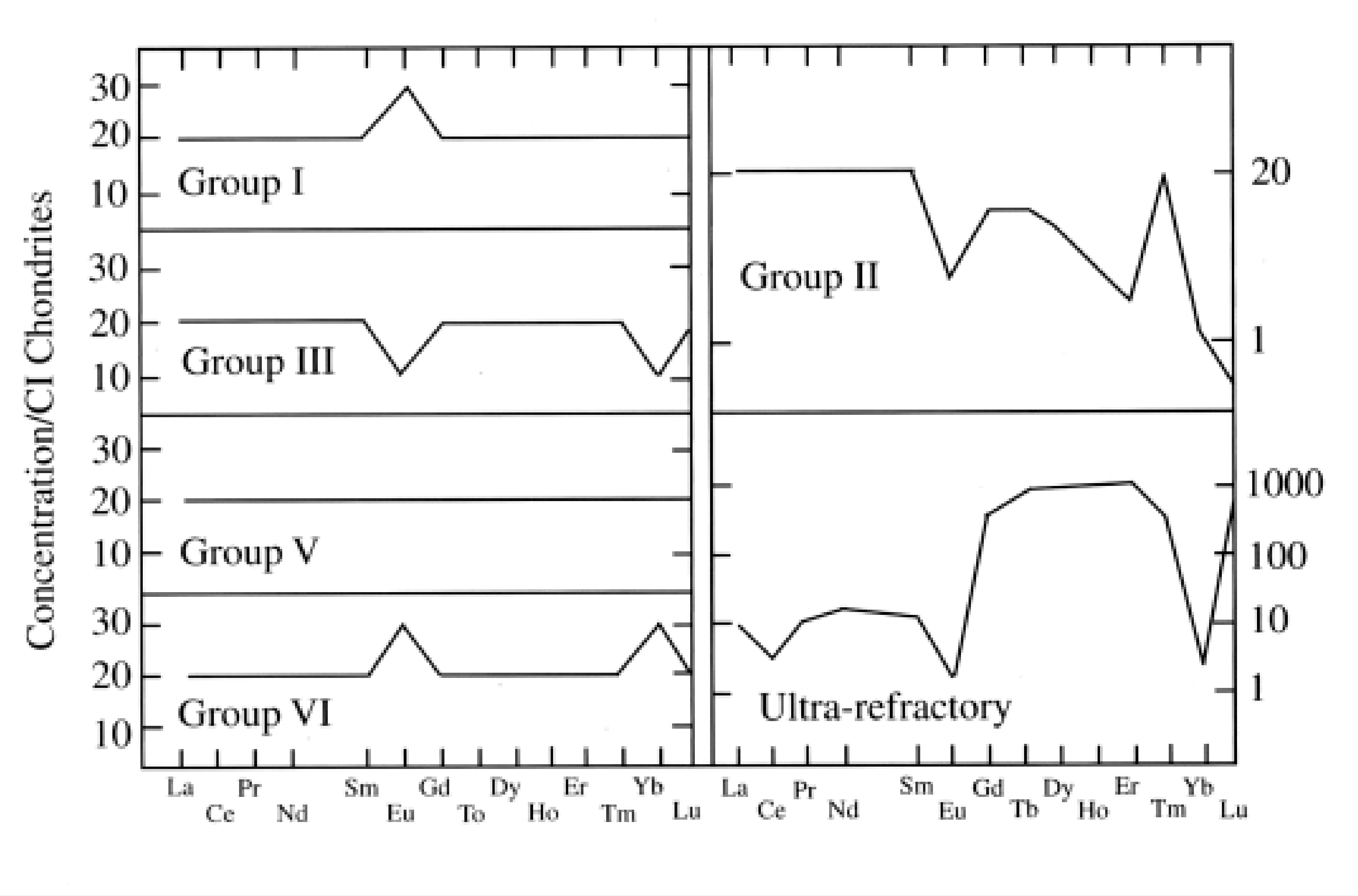
(Wadhwa & Russell)

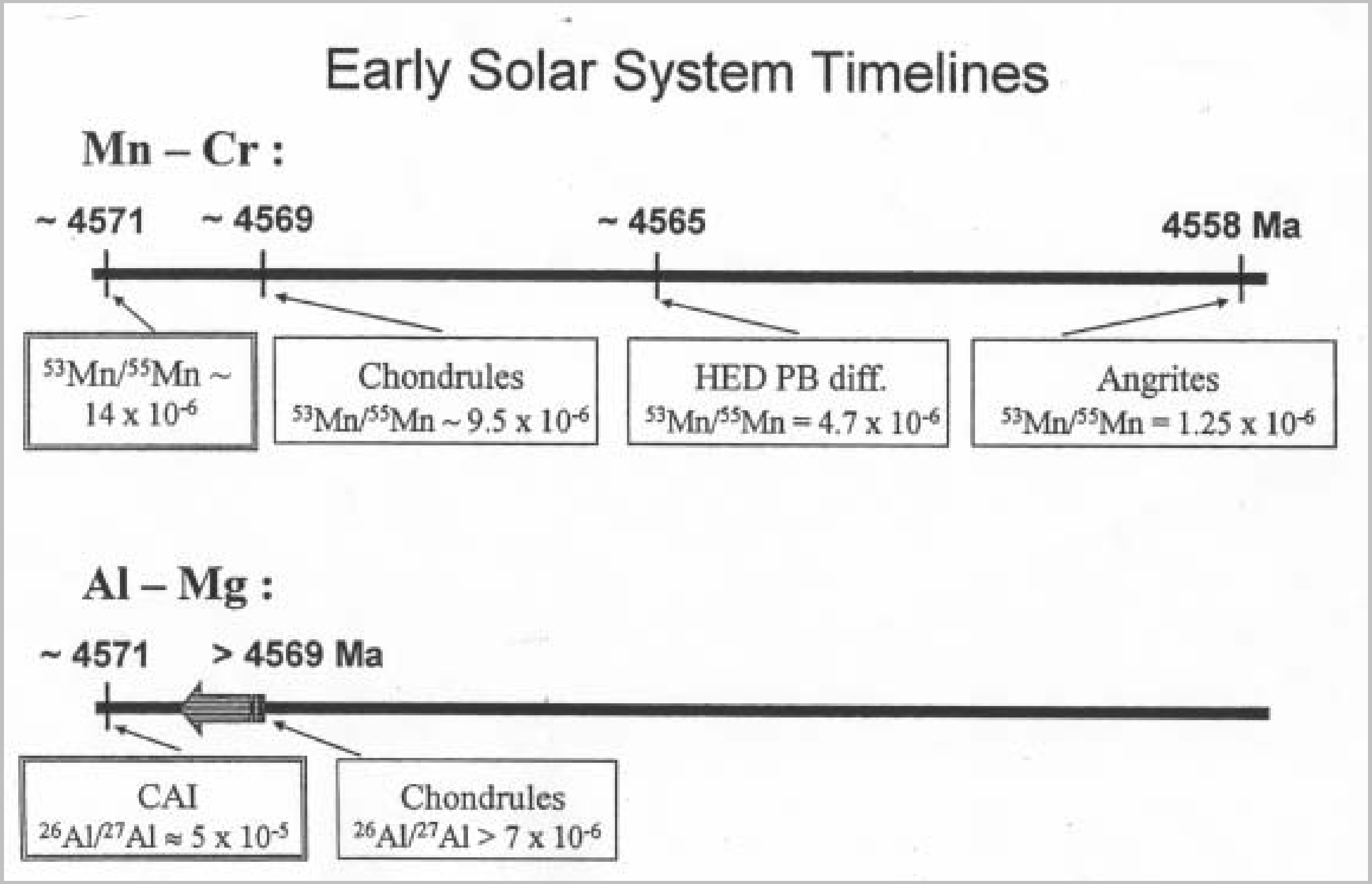


Early solar system chronology based on ^{53}Mn-^{53}Cr (Lugmair)



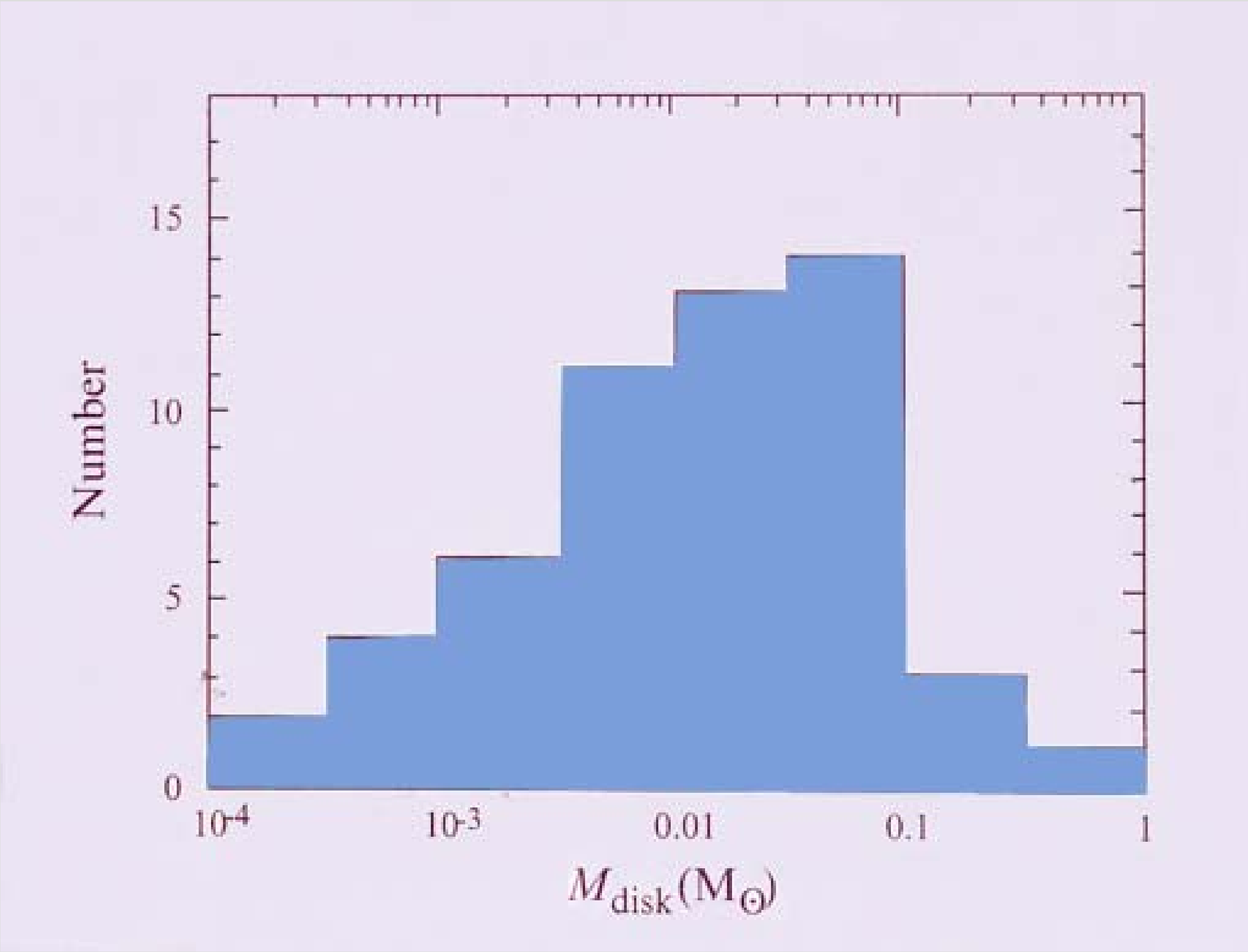
Rare earth element (REE) patterns in CAIs (refractory inclusions)



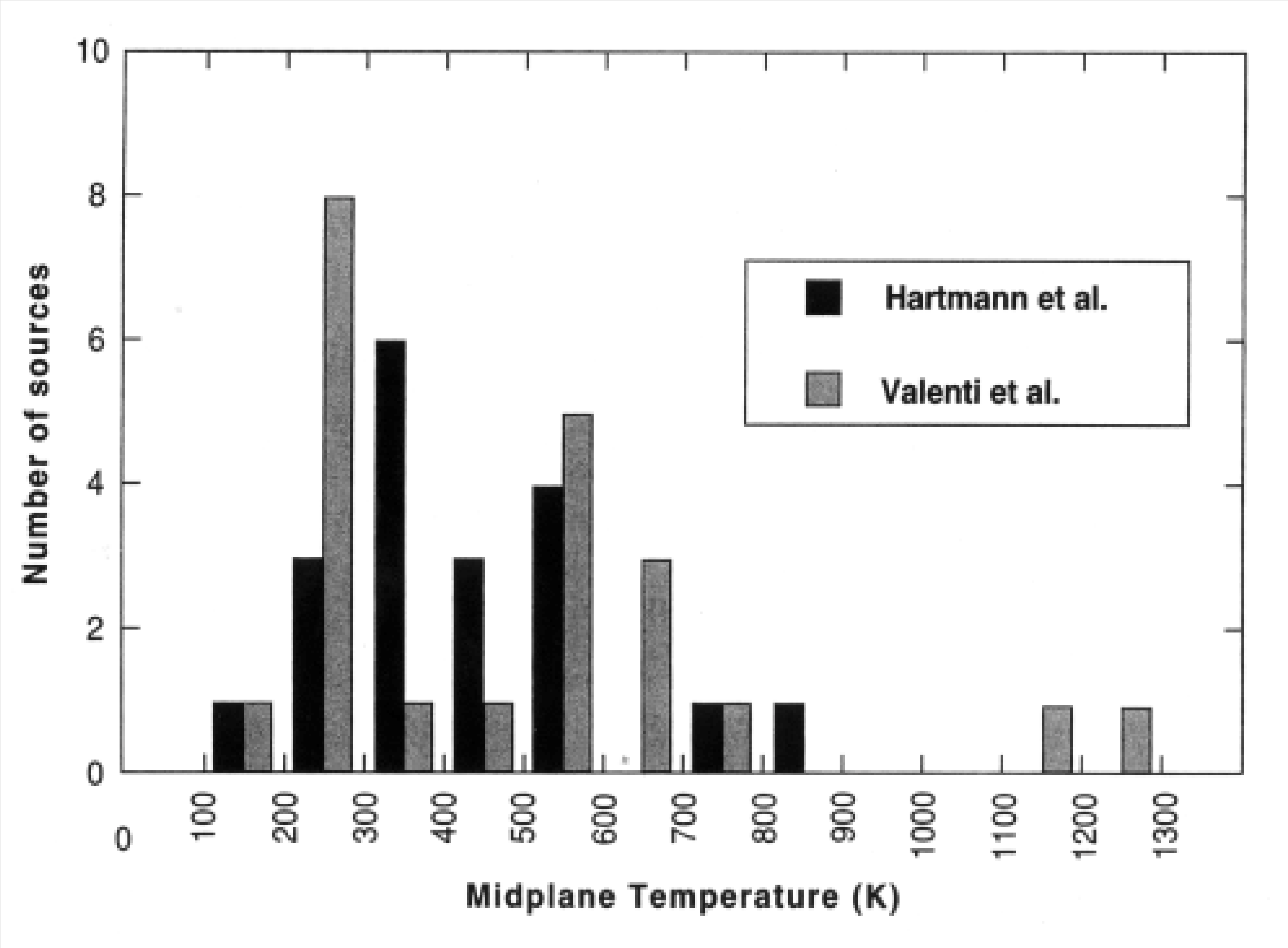


(after Lugmair)

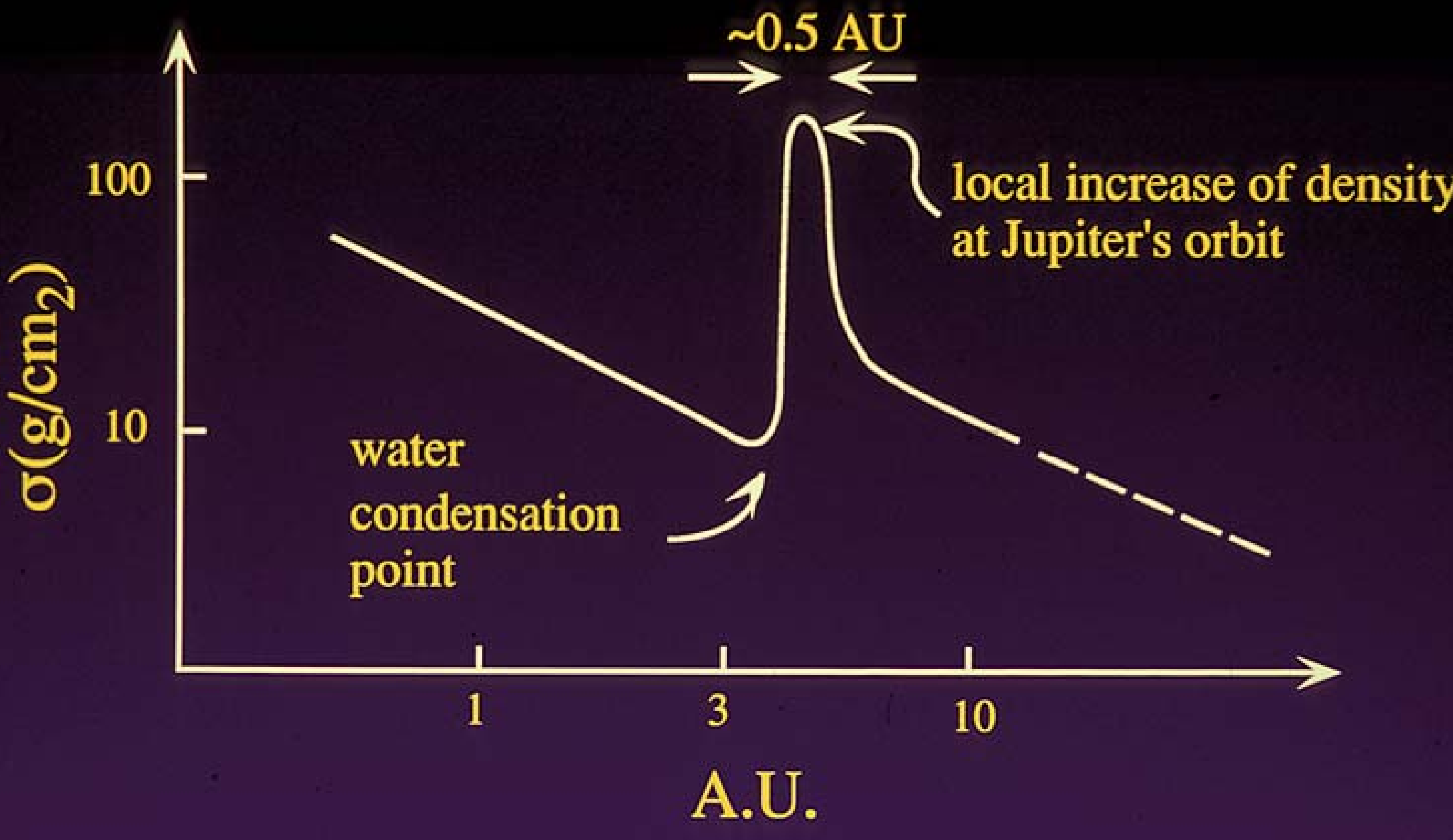
Disk masses around young stars in Taurus and Rho Ophiuchus
(Chandler)

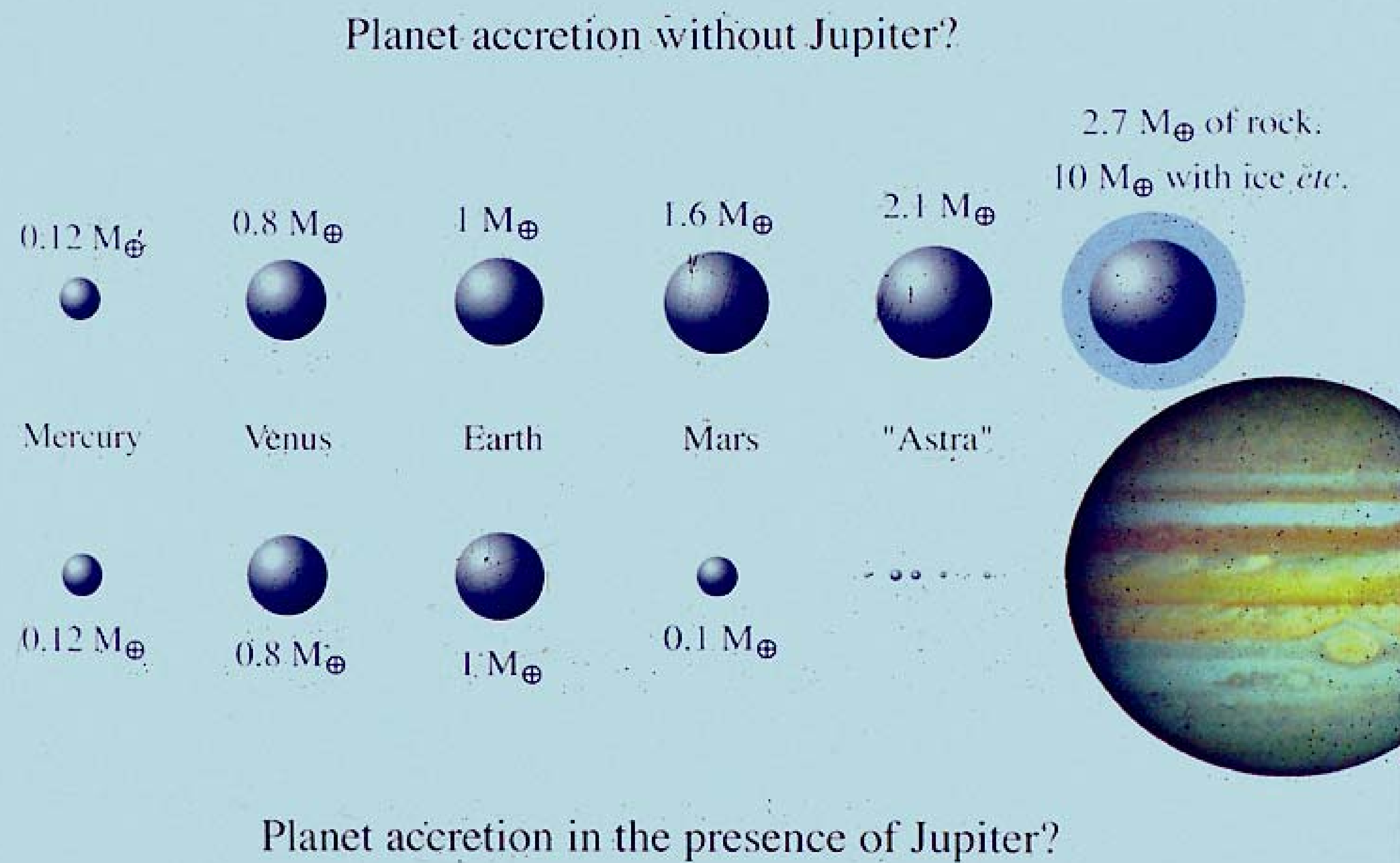


Midplane temperatures (K) in disks around T Tauri stars



Density distribution as a function of distance from a proto-sun
(Dave Stevenson)

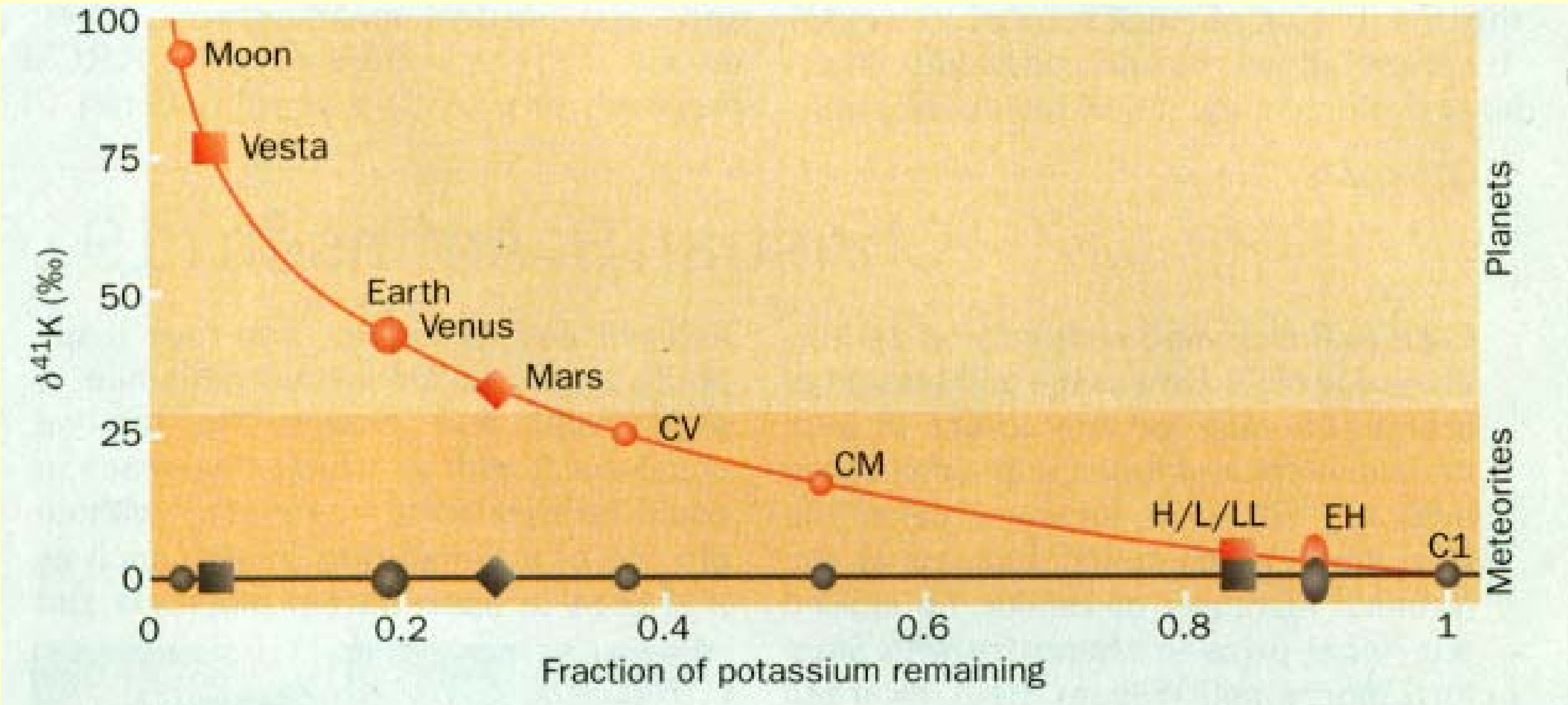




(after John Wood)

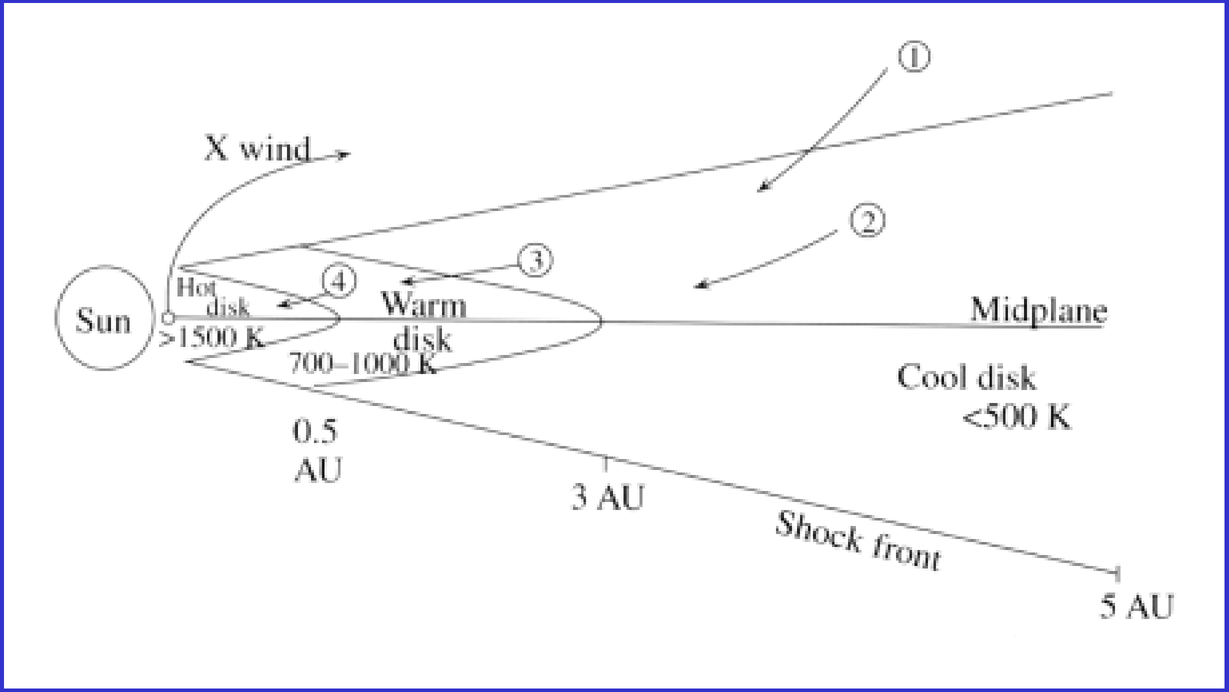
Potassium isotopic compositions in the inner solar system

(Humayun & Clayton)



bottom line = observed; upper curve = calculated for Rayleigh distillation

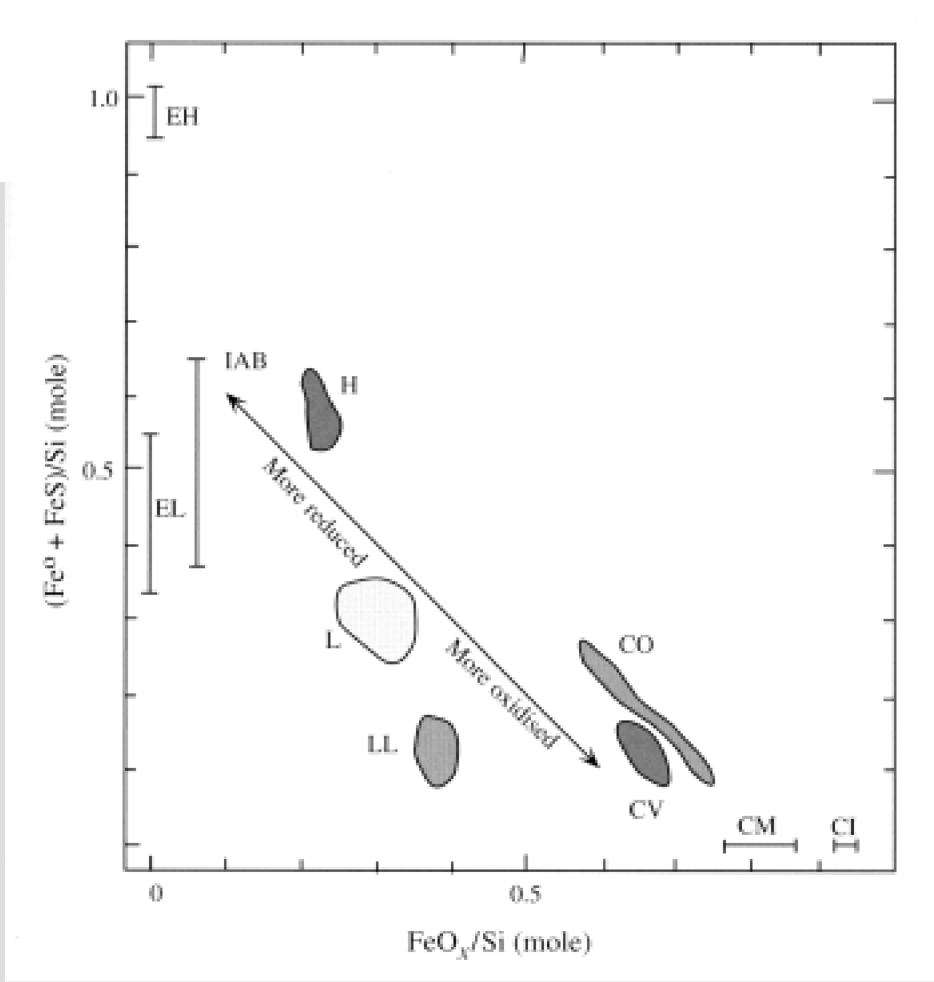
A representation of the nebular disk during accretion of the sun.



(1)Grains accreting to the cooler outer regions of the disk are (2) transported inwards. (3)Grains entering the inner warm zones of the disk are selectively vaporized. Refractory olivines and pyroxenes will survive into the central regions but feldspathic grains (containing potassium) will be vaporized. (4)All grains entering the inner region will be vaporized. The hot innermost zone (> 1800 K), the source of the X wind, is a possible site for forming CAIs. The vaporized material will either be accreted to the sun or swept out by T Tauri-type winds. The total vaporization of feldspathic grains can account for the depletion of potassium in the inner nebular without any accompanying isotopic fractionation. (Ed Young)

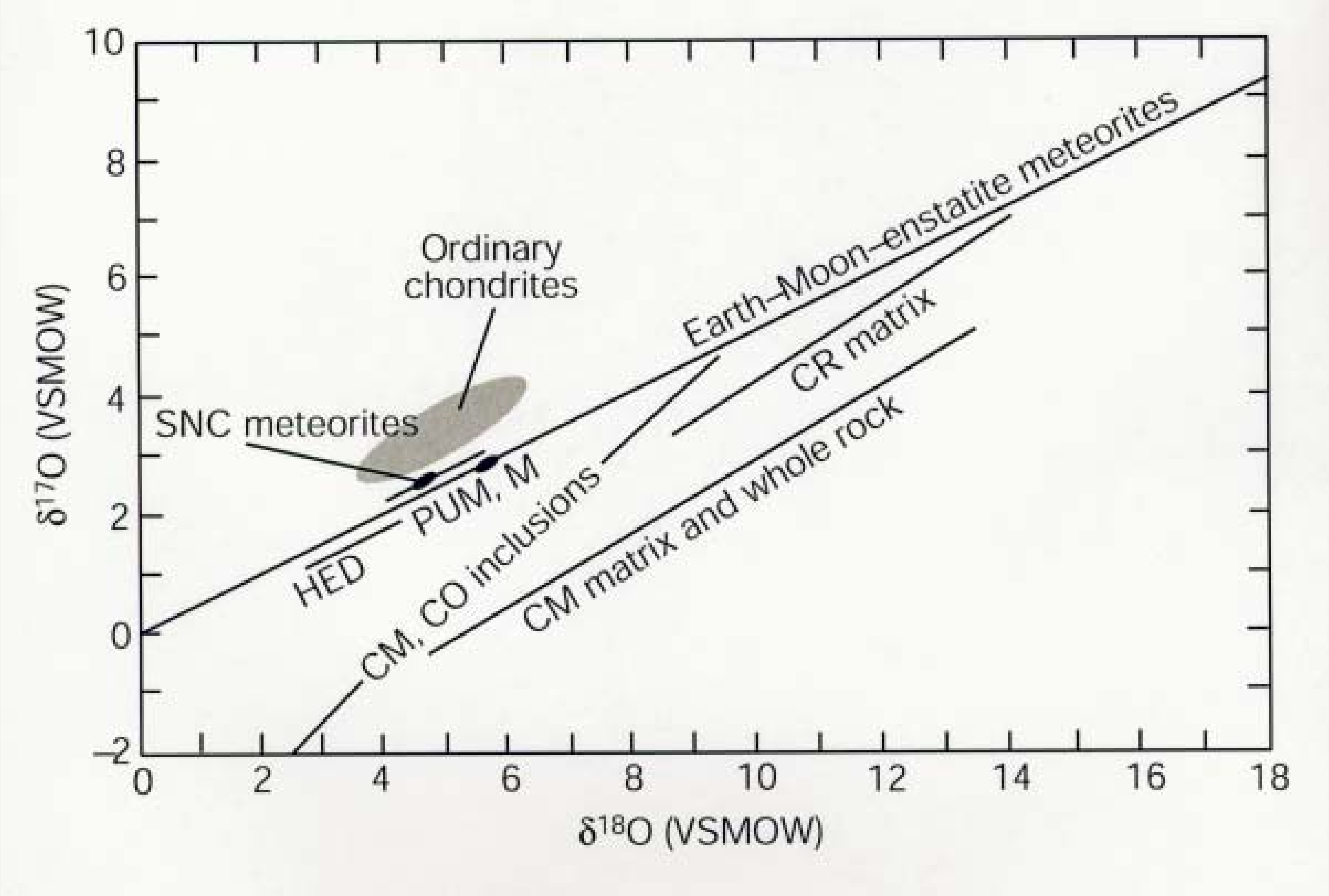
S-type asteroid Ida
(56 x 24 x 21 km)

Variation in oxidised and reduced iron in chondritic meteorites



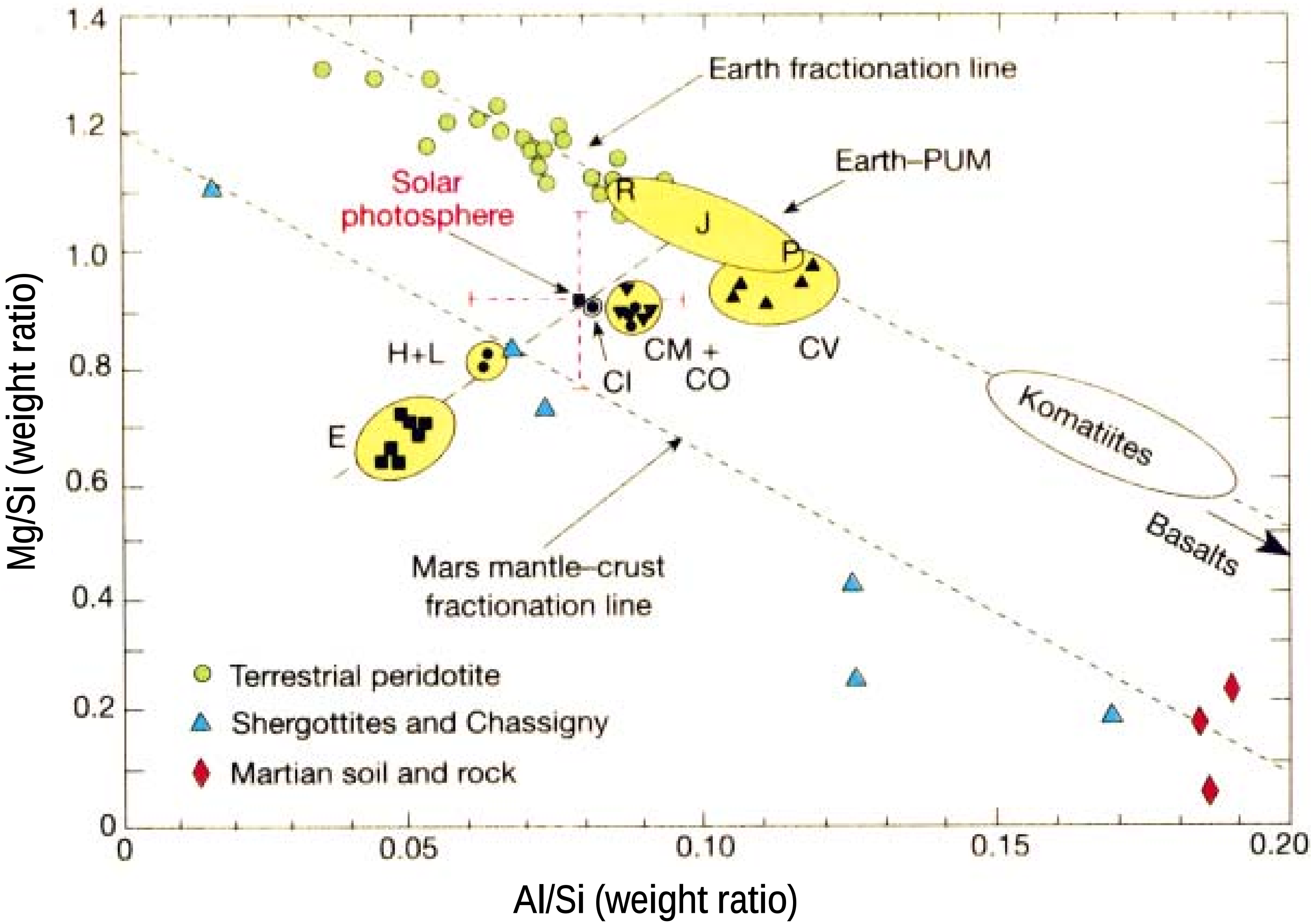
Oxygen isotope variations in the inner nebula

(Clayton)

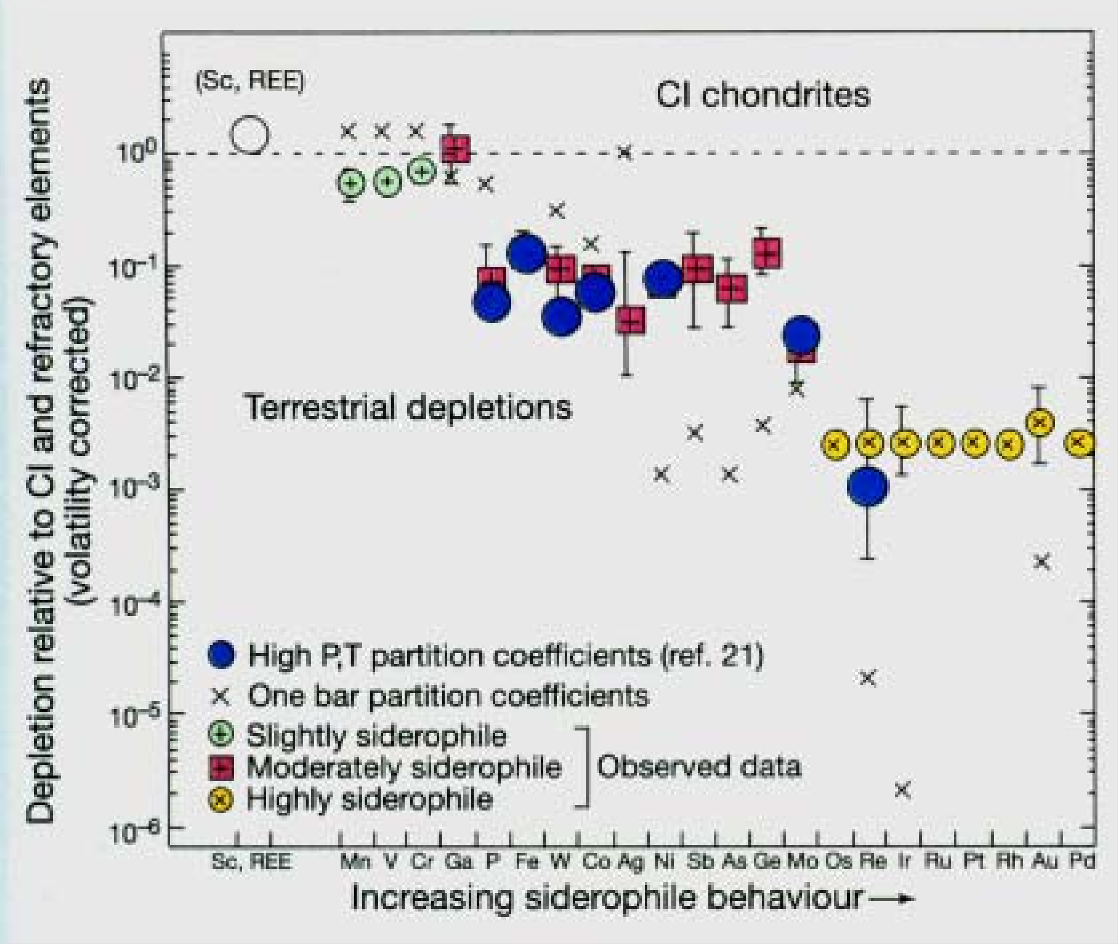


Variation in major elements in meteorites, Mars (?) and Earth

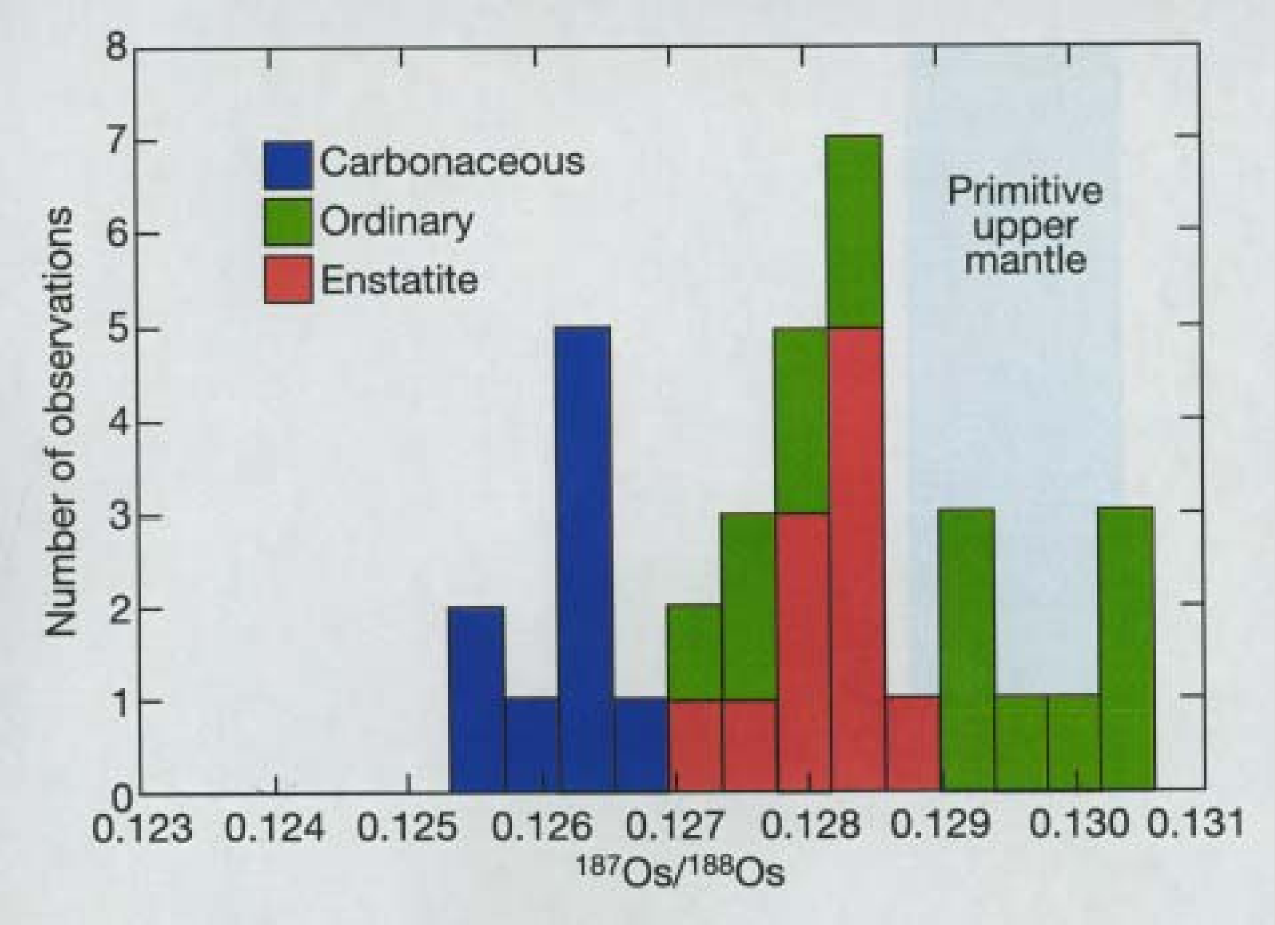
(Wänke, Palme, Righter and Drake)

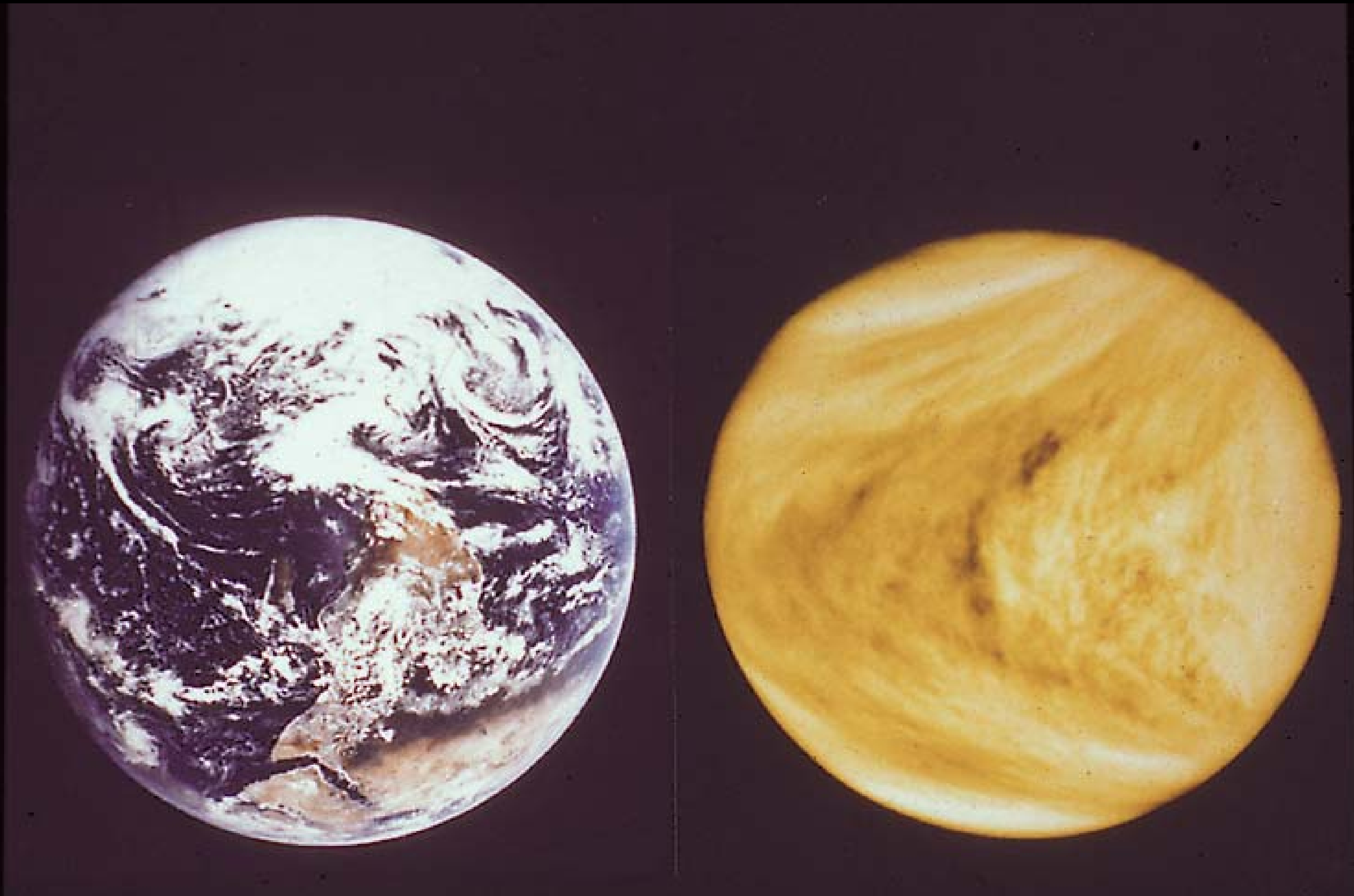


Abundance of siderophile elements in the terrestrial upper mantle



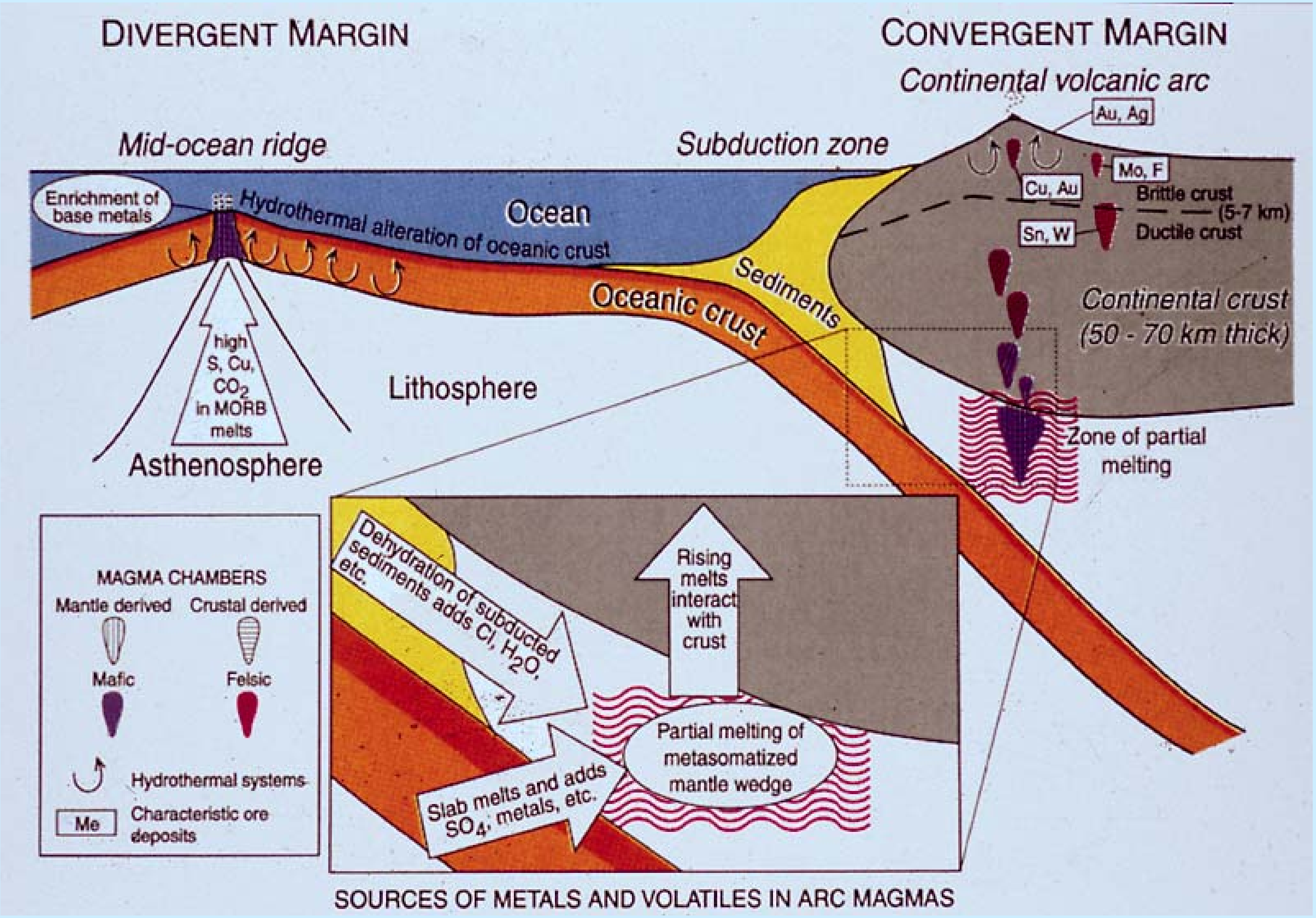
Osmium isotope ratios (^{187}Re-^{187}Os) in meteorites and the terrestrial upper mantle



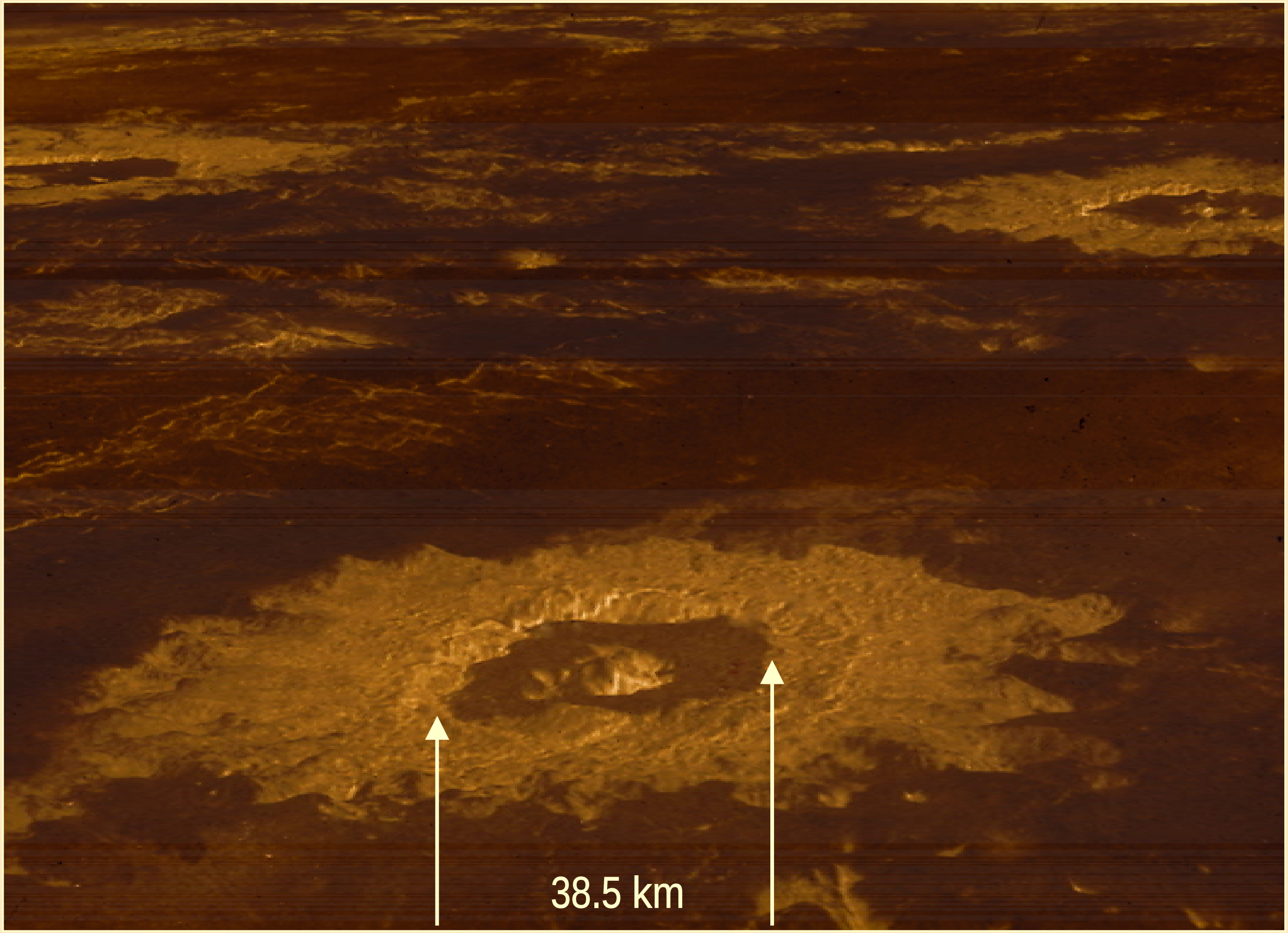


Earth and Venus at the same scale

TERRESTRIAL PLATE TECTONICS

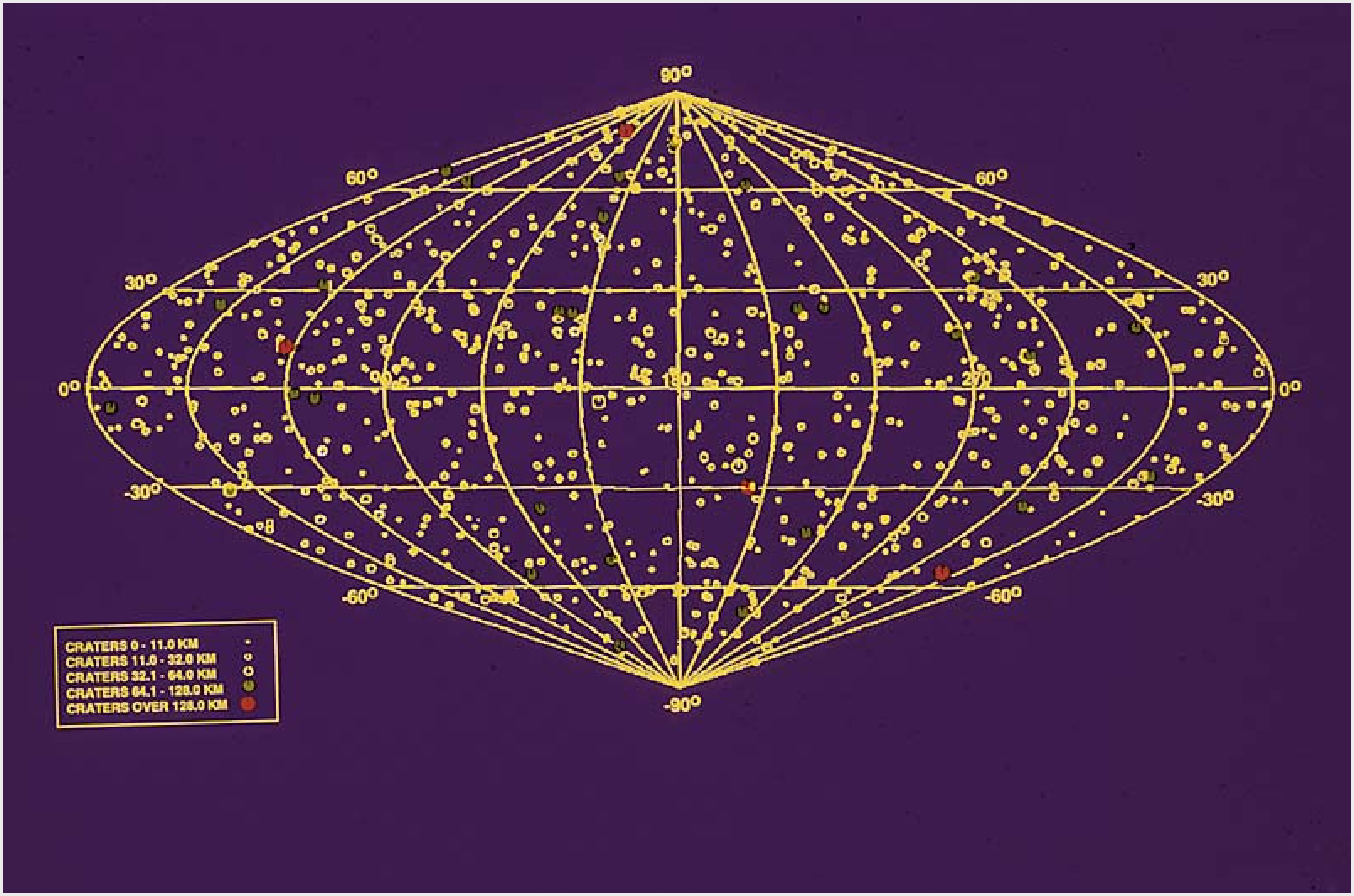


Julia Ward Howe Crater on Venus

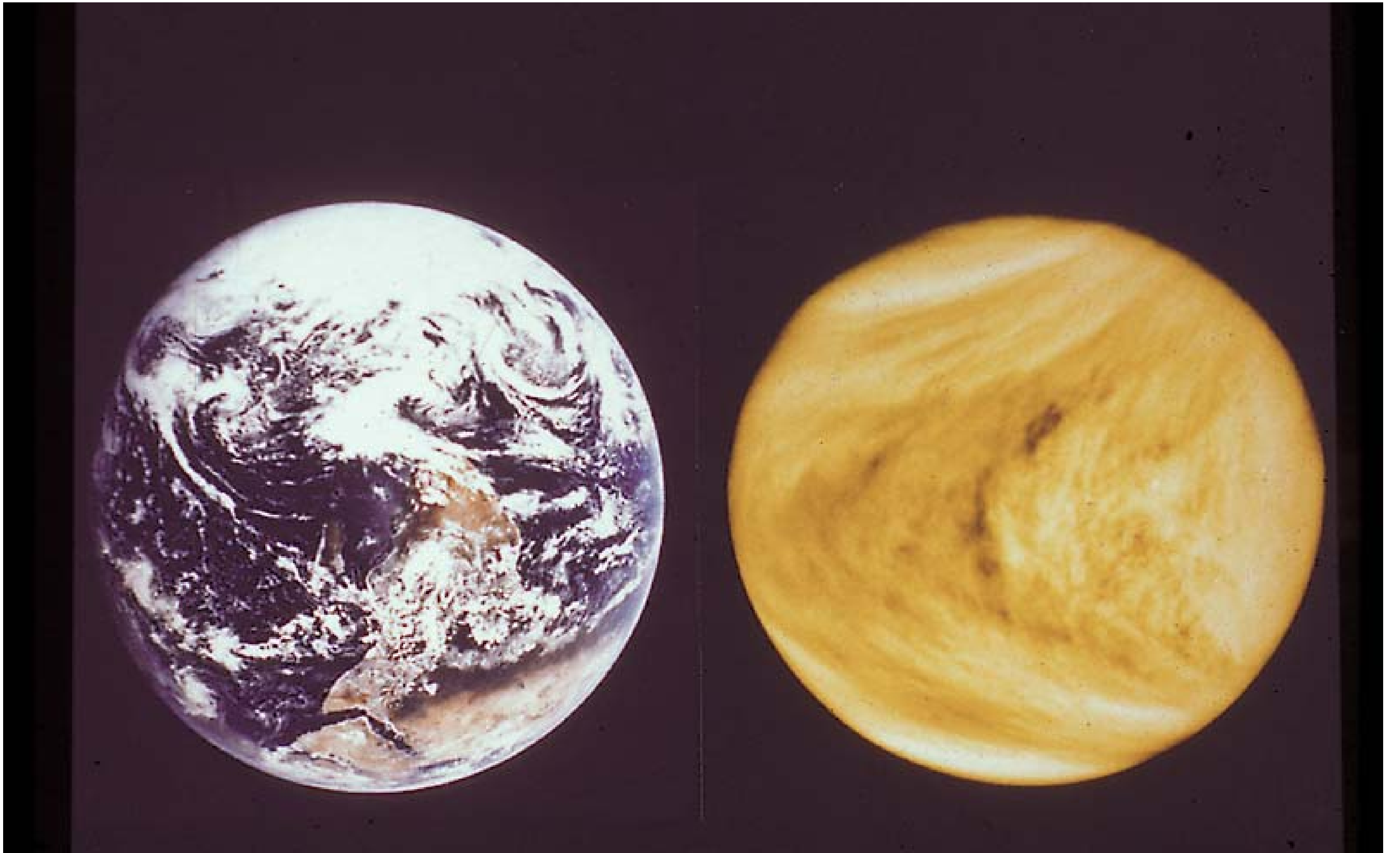


Distribution of impact craters on Venus

(Bill McKinnon)




RAPHAEL es Jekyll
RAPHAEL es Hyde
en
Jekyll & HYDE
Una producción de
LUIS RAMIREZ
Highlights del
Musical Original
en Castellano

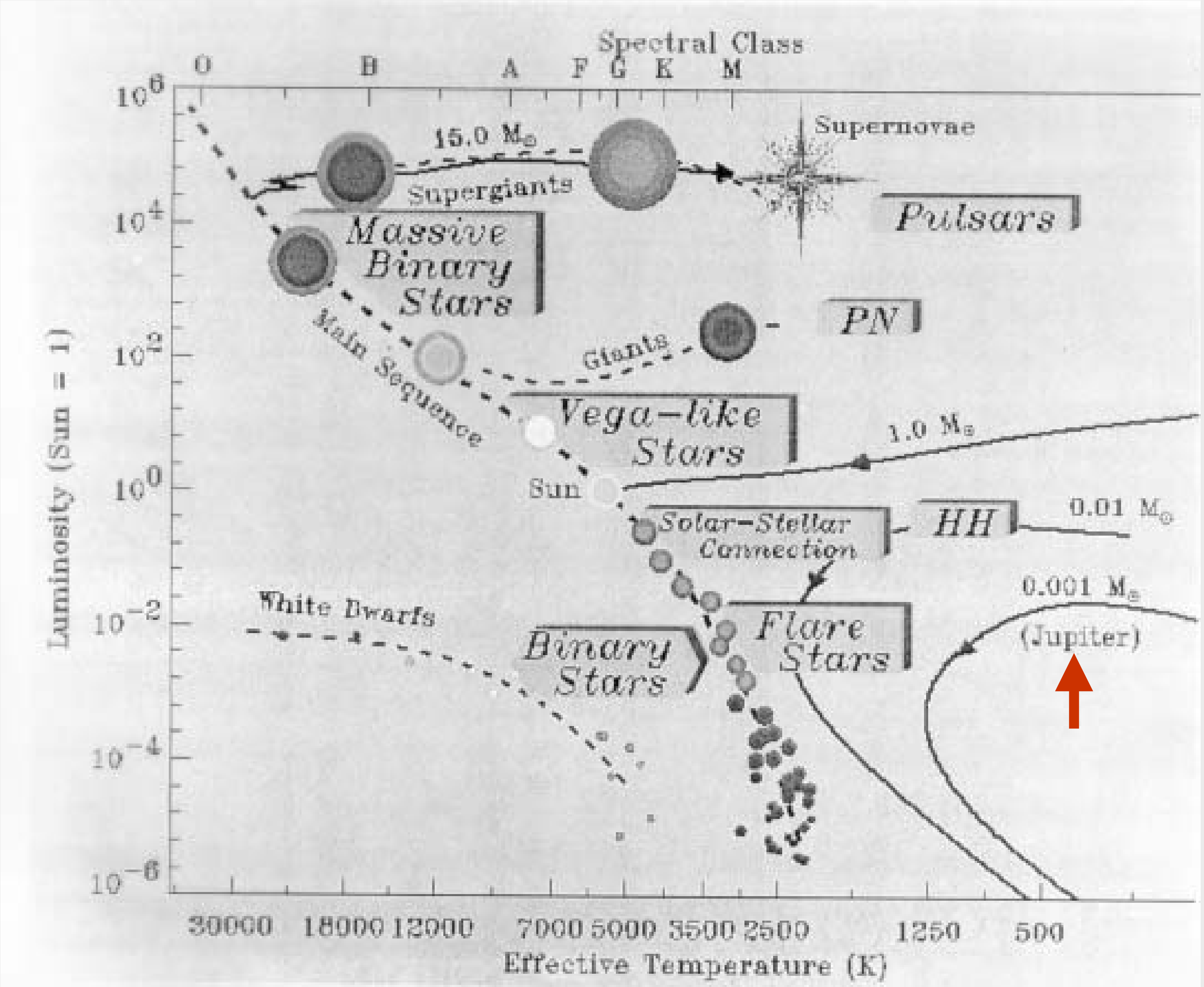


Earth and Venus at the same scale

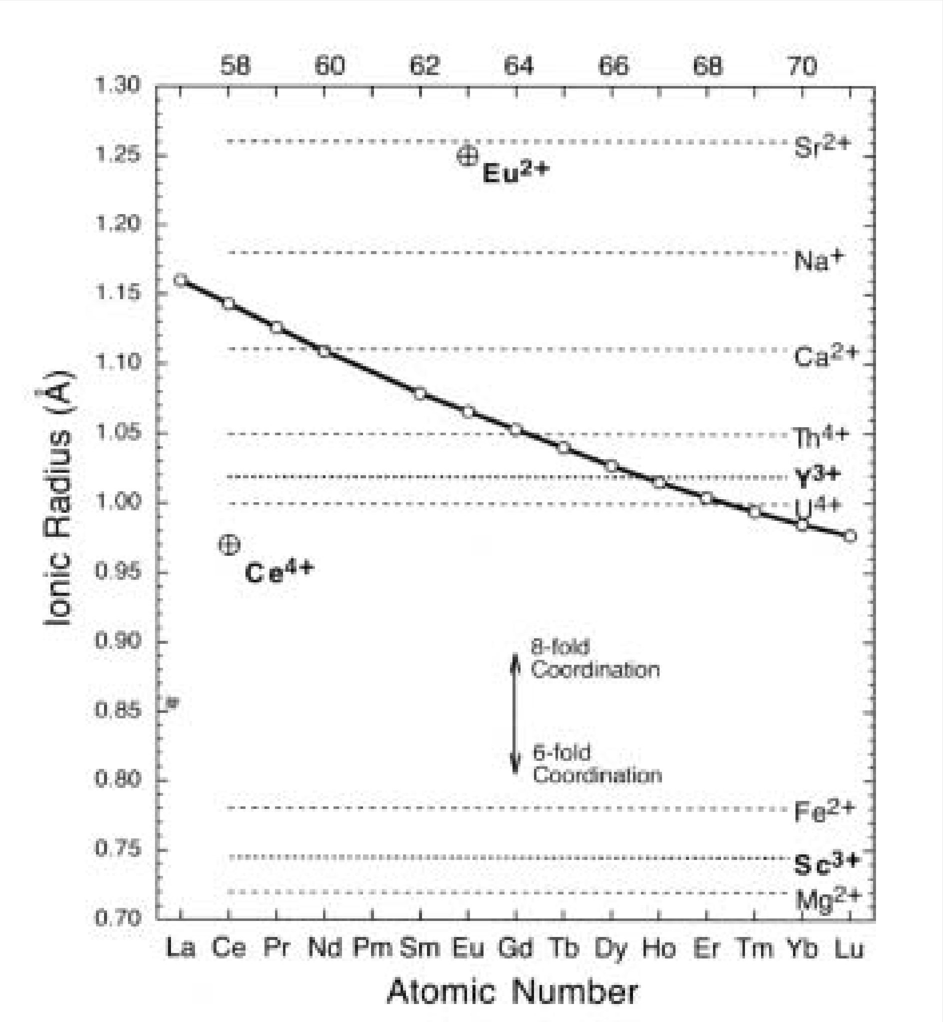
There are indeed few chances that [conditions for life] would be found united in any globe.
Nature has consequently had to form a great number of worlds for one habitable milieu to be produced.

Hervré Faye (1885)
Sûr l'origine due Monde (2nd ed) Paris, pp 299 - 300

Hertzsprung-Russell Diagram



Rare earth element ionic radii



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On the possibility of Earth-type habitable planets around 47 UMa

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Let us emphasize that we assume an Earth-like planet with plate tectonics, a crucial ingredient for our models.

we find that Earth-type habitable planets around 47 UMa are in principle possible!

Short-lived, Now Extinct Radioisotopes for which evidence has been found in Meteorites

Radioisotope	Half-life (million years)	Daughter isotope	Reference isotope	Initial ratio
^{41}Ca	0.10	^{41}K	^{40}Ca	1.5×10^{-8}
^{26}Al	0.73	^{26}Mg	^{27}Al	5×10^{-5}
^{10}Be	1.5	^{10}B	^{2}Be	$\sim 5 \times 10^{4}$
^{60}Fe	1.5	^{60}Ni	^{56}Fe	$\sim 10^{-6}$
^{53}Mn	3.7	^{53}Cr	^{55}Mn	$\sim 10^{-5}$
^{107}Pd	6.5	^{107}Ag	^{108}Pd	4.5×10^{-5}
^{182}Hf	9	^{182}W	^{180}Hf	10^{-4}
^{129}I	16	^{129}Xe	^{127}I	10^{-4}
^{244}Pu	81	Fission Xe	^{238}U	$(4\text{-}7) \times 10^{-3}$
^{146}Sm	103	^{142}Nd	^{144}Sm	$(5\text{-}15) \times 10^{-3}$